[Part 11. Reprinted 1958]

IMPERIAL MYCOLOGICAL INSTITUTE

REVIEW

OF

APPLIED MYCOLOGY

VOL. XIX NOVEMBER 1940

ZOSSIMOVITCH (V. P.). **New hybrids of wild and ordinary Beets resistant to Cercospora.**—*Plant Breed. & Seed Grow.*, ix, 1, pp. 12–16, 1939. [Russian. Abs. in *Facts ab. Sug.*, xxxv, 7, p. 36, 1940.]

The results of hybridization experiments between the common beet and *Beta maritima* of western European origin denoted the possibility of developing strains resistant to *Cercospora* [*beticola*]. The cultural types arising as early as the F_2 generation approximated closely to the normal in respect of root form and sugar content, and under conditions favouring heavy infection produced higher yields than the E strains [*R.A.M.*, xvii, p. 284]. Back-crossing of the hybrids with sugar beets has been successfully carried out, and the outlook for the development by this means of productive, resistant varieties is very promising.

UPPAL (B. N.). **Appendix K. Summary of the work done under the Plant Pathologist to the Government of Bombay, Poona, for the year 1938–39.**—*Rep. Dep. Agric. Bombay, 1938–9*, pp. 203–211, 1940.

The following are among the items of interest in this report [cf. *R.A.M.*, xviii, p. 437]. The *Fusarium* causing wilt of *Lathyrus sativus* was found to make good growth between 17° and 31° C., with an optimum between 25° and 27°, earliness of attack and severity of infection being characteristic features of the disease at 25°. Two of the five *L. sativus* strains from the Institute of Plant Industry at Indore tested for resistance to wilt gave very promising results, viz., 'type 1, plant 37' and 'type 148, plant 2'. Selections for wilt resistance have been made from the crops in the Poona and Broach districts and will be further tested in the infected plot.

The causal organism of soft rot of ginger has been identified as *Pythium myriotylum* [ibid., xviii, p. 472], the oogonia of which measure 22 to 41 μ and the oospores 16·5 to 30 μ in diameter.

Mottle leaf of oranges, which occurs in a severe form in Gujarat and the Deccan, proved amenable to treatment with a zinc sulphate-lime mixture (5–2½–50) plus casein or agral I or II.

The Kali and Basri banana varieties, the latter a good commercial type, showed a high degree of resistance to Panama disease [*F. oxysporum cubense*] in trials in heavily infested soil near Narayangaon, where the local Sone variety was entirely susceptible.

Types of cotton showing 100 per cent. resistance to wilt [*F. vasinfectum*] (p. 33) have been isolated from the cross (B.D. 8×S. 7–1) and the Broach back-cross (B.D. 8×G.A. 26)×B.D. 8, and B.D. 8 [ibid., xix, p. 15]. Similar results have been obtained with some of the *Gossypium arboreum* var. *neglectum* cottons now being used as parents in crosses with Jarila and N.R. 5 with a view to securing a fully resistant type possessing the staple of Jarila and other desirable economic characters for extension in the Khandash tract. Very promising results have also been given in the Jalgaon Section by the Million Dollar and New Million Dollar selections, the latter originating in China.

HOPKINS (J. C. F.). **Annual Report of the Senior Plant Pathologist for the year ending 31st December, 1939.**—*Rhod. agric. J.*, xxxvii, 7, pp. 411–423, 1940.

In this report on plant disease work in Southern Rhodesia in 1939 [cf. *R.A.M.*, xviii, p. 784] it is stated that *Nematospora coryli*, previously found in Rhodesia only in internally rotted cotton bolls, was isolated from sunn hemp [*Crotalaria juncea*] seeds. The percentage of infected seeds in the lots examined was very high, only 42 to 59 per cent. of the plants grown from commercial and specially selected seed sown in pots surviving. Seed treated with mercurial dusts and sown in beds showed no significant increase in number of plants surviving over the controls, percentage survival ranging from 49 to 59 per cent. The evidence indicated that infection followed puncturing of the partially developed pods by *Aspilocryphus fasciativentris*.

Maize lodging was caused by *Gibberella saubinetii*, which produced rotting of the pith, crown roots, and anchor roots. Germination tests revealed a deplorable amount of infection of maize seed by cob-rotting fungi (*G. saubinetii*) [and *Diplodia zeae*: ibid., xix, p. 83], attributable to slackness in seed selection coupled with heavy rains in the previous season. Growers must reject for seed purposes cobs showing even the smallest amount of discoloured grain and should adopt seed disinfection with mercurial dusts as a routine practice.

Imported Up-to-Date potatoes showed the presence of a rather large amount of powdery scab (*Spongospora subterranea*), while most consignments also contained a small percentage of tubers infected by *Actinomyces scabies*. When diseased and healthy 'seed' was planted in pots in the laboratory neither disease appeared in the subsequent crop. It is improbable that powdery scab survives in Rhodesian soils, while *A. scabies* is of no importance in good, fertile soils.

About 20 per cent. of a consignment of Hindenburg potatoes imported from Poland appeared to be affected by spindle tuber [ibid., xviii, p. 155].

A disease of papaw trees apparently identical with mosaic as found in Trinidad [ibid., xviii, p. 808] was recorded for the first time.

Tobacco wildfire [*Bacterium tabacum*: ibid., xviii, p. 483] was exceptionally prevalent, appearing in all tobacco areas and in many instances on new farms. Field spraying has been adopted by numerous growers. The reason for the outbreak has not yet been ascertained. The abnormally heavy rains experienced early in the season would have induced

severe attacks, but natural spread fails to explain the sudden appearance of a few infected plants in one corner of a piece of land, or the presence of a disease patch three yards long in one seed-bed among hundreds on one farm, or general infection in all plantings on a new farm where tobacco has not previously been grown, 20 miles away from the nearest tobacco.

Brown spot (*Alternaria longipes*) [loc. cit.] caused very heavy losses almost everywhere. By destroying most of the full-bodied leaf, the outbreak was largely responsible for the short weight and light texture of the crop. Many growers who had not been troubled with the disease before lost the top three or four leaves of their entire crop, while others saved their plants only by allowing suckers to grow unchecked, so reducing the body of the leaf.

Tobacco rosette [ibid., xviii, p. 347] was very widespread, but caused little damage, most growers recognizing the disease and roguing out the affected plants.

'Little leaf' [ibid., xix, p. 197] was widely prevalent on all kinds of deciduous fruit trees, including vines. Applications of zinc sulphate in some cases produced immediate response.

New records included *Sclerotium rolfsii* on apricot roots, *Verticillium* (?) *agaricinum* causing mouldiness of cultivated mushrooms (*Pholiota* sp.), *Phomopsis* (probably *Diaporthe phaseolorum*) [ibid., xv, p. 277] on tomato fruits, cassava mosaic, *Fusarium scirpi* var. *filiferum* in cotton bolls, *Plectodiscella* [*Elsinoe*] *veneta* on loganberry stems and leaves, *F. bulbigenum* var. *lycopersici* on carnation roots, *Phyllosticta solitaria* [ibid., xvii, p. 608] on the apple, *Stachylidium theobromae* and *Glomerella cingulata* on banana fruits, and *F. moniliforme* [*Gibberella fujikuroi*] and *Phytophthora citrophthora* on lemon fruits.

Fourteenth Annual Report of the Department of Scientific and Industrial Research, New Zealand, 1939–1940.—100 pp., 2 maps, 1940.

On pp. 17–54 of this report [cf. *R.A.M.*, xix, p. 70] G. H. Cunningham states that during the period under review plant diseases recorded in New Zealand for the first time included *Sclerotinia sclerotiorum* on imported kumara [sweet potato] tubers, scald (*Rhynchosporium secalis*) [*R.A.M.*, xix, p. 119] on commercial malting barley, and wilt (*Polyspora lini*) [ibid., xviii, pp. 127, 256] on linen flax. As the list of new diseases imported into New Zealand increases every year, it is evident that stricter quarantine regulations are necessary. *Phoma lingam* was found on cabbage stems in Auckland, a new record for this host in New Zealand.

Only one biotype of wheat stem rust (*Puccinia graminis*) was found during the past season, though in previous years two (Nos. 34 and 45) were isolated by overseas workers. Seven biotypes of wheat leaf rust (*P. elymi*) [*P. triticina*] appear to be present, and at least two of loose smut (*Ustilago tritici*). A study of ergot strains from different grasses showed only *Claviceps paspali* [ibid., xviii, p. 658] and *C. purpurea* [ibid., xix, pp. 272, 391] to be present, the former on *Paspalum* only, the latter on a wide range of grasses including rye grass [*Lolium perenne*], cock's foot [*Dactylis glomerata*], Yorkshire fog [*Holcus lanatus*], and tall fescue [*Festuca elatior*]. Proof was obtained that ergot does not

perennate in the host, and cannot be toxic to stock except when grasses are allowed to seed.

In trial plots, all varieties of French beans [*Phaseolus vulgaris*] became affected by bacterial wilt (*Bacillus* [*Bacterium*] *medicaginis*) [ibid., xiv, p. 140], only two, viz., the Burnley selection of Canadian Wonder and Pale Dunn, showing some resistance.

Evidence was obtained that tomato streak is due to a combination of tobacco mosaic and an unidentified virus [ibid., xix, p. 372].

The oil variety of flax, Rio, was ascertained to be resistant to *Fusarium lini* and immune from browning (*Polyspora lini*). Ten minutes' seed immersion in water at 126° eliminated *P. lini*, and by this means small nuclei lines of clean seed were obtained.

In glasshouse tests under commercial conditions shirlan AG (containing 25 per cent. salicylanilide) gave excellent control of tomato leaf mould [*Cladosporium fulvum*: ibid., xix, p. 243].

'Eye rot' or 'dry eye rot' of Jonathan and Cox's Orange apples, caused by *Botrytis cinerea* and common in the Nelson district, has been responsible for the rejection of fruit from export, as it was considered that fungal growth might continue. Attempts to isolate the fungus from infected apples were unsuccessful, and it is concluded the fungus was no longer viable in the lesions.

At Hawke's Bay, apple black spot [scab: *Venturia inaequalis*] was controlled by a spraying programme with lime-sulphur (1 in 300) plus colloidal sulphur (50 per cent. sulphur content) at 1 lb. per 100 gals., adjacent control trees having up to 20 per cent. infection. At Huapi, lime-sulphur (1 in 200) plus colloidal sulphur (25 per cent. sulphur content) at 2 lb. per 100 gals. gave control of both scab and powdery mildew [*Podosphaera leucotricha*], though the controls became heavily infected. In one programme in which Bordeaux mixture replaced sulphur from December onwards, apparent control of *P. leucotricha* was obtained, the fungus being absent from the treated trees, but present on the controls.

Pear black spot (*V. pirina*) was controlled by Bordeaux mixture (1½–2–50) instead of 3–4–50, applied after blossoming, the treatment causing much less russeting than the stronger concentration. As in earlier seasons, infection was much more difficult to control on trees heavily infected before, indicating that the source of carry-over was infected twigs.

A survey of commercial strawberry areas showed that yellow edge [see below, p. 661] was present in every planting. The most serious raspberry cane disease in New Zealand is that caused by *Leptosphaeria coniothyrium* [ibid., xvi, p. 47], which can be effectually combated by three applications of Bordeaux mixture.

Citrus mottle leaf again showed immediate response to spray applications of manganese [ibid., xix, p. 70], though soil treatments [with the same material] had no effect. Determinations made on samples of healthy, slightly mottled, and badly mottled citrus leaves showed the presence of 20·2 and 24, 10·2 and 15·4, and 4·7 and 6·2 p.p.m. manganese in dry matter, respectively. Magnesium was also low in badly mottled leaves.

In further investigations on the refrigerated gas storage of fruit,

Jonathan apples stored at 42° F. in 9 per cent. carbon dioxide with 12 per cent. oxygen remained completely free from Jonathan spot [ibid., xviii, p. 657], though the controls, stored in air, became markedly affected. Superficial scald [ibid., xix, p. 290] was severe on Sturmer apples cool-stored in air, but failed to develop on fruit stored in atmospheres of over 3 per cent. carbon dioxide, in which, further, fungal wastage was greatly retarded, such wastage being almost completely eliminated in atmospheres containing 9 per cent. of the gas.

Studies on the effect of manurial treatments on the storage quality of apples showed that 4 lb. ammonium sulphate per tree, given in addition to a normal dressing of phosphate and potash, markedly increased susceptibility to breakdown in Dunn's Favourite. With Jonathan apples, nitrogenous dressings in the 'off' year increased the amount of breakdown and fungal infection, such increase being roughly proportional to the amount of nitrogen used; nitrogen and potash both increased susceptibility to Jonathan spot, though injury was very slight. Most samples of Sturmer apples showed a high percentage of wilting, but fruits from trees given nitrogen alone were frequently subject to breakdown and resistant to wilt. Phosphate treatment increased wilt but reduced breakdown. When two applications of both 0·1 and 0·25 per cent. borax sprays were made on Cox's Orange Pippin, Jonathan, and Sturmer apples, the boron content of the fruit was markedly increased, but storage quality remained unaffected. Trees treated with 3 lb. borax per tree three years ago are stated still to bear fruit showing liability to breakdown. When the boron content of the fruit rises above 30 p.p.m. the storage quality of the fruit suffers [ibid., xix, p. 604].

One shipment of oranges from Raratonga, Cook Islands, contained 40 per cent. wastage, caused by *Phytophthora citrophthora*, while another, from Aitu, showed up to 30 per cent. wastage due to *Oospora citri-aurantii*, introduced into the packing cases on windfalls.

Plant diseases. Notes contributed by the Biological Branch.—*Agric. Gaz. N.S.W.*, li, 7, pp. 383–386, 4 figs., 1940.

All commercial varieties of strawberries grown in New South Wales have now become affected by crinkle [*R.A.M.*, xviii, pp. 537, 604], with the result that most growers find this crop unprofitable. The disease was probably introduced on some new variety, though the actual date of introduction is unknown. Planting material should be selected only in late autumn and winter, when symptoms are most pronounced. Runners should be taken only from healthy plants and those selected set at least 100 yds. from affected beds. In spring and late autumn the new beds should be carefully rogued of all affected plants and all their runners. If the planting is extensive, a special nursery bed should be maintained, to which detailed attention can be given. Runners purchased from nurserymen should be carefully examined. The most promising variety to plant is Cresswell Seedling, which has shown some degree of resistance.

Potato hollow heart [ibid., xix, p. 299] is common in certain large-tubered, rapidly growing varieties during wet seasons or in very fertile soils, and appears to be induced by an over-rapid or irregular growth

rate. Control consists in regulating the rate of growth of developing tubers by selecting varieties whose growth progresses at a normal rate and by exercising care in the use of fertilizers and water; closer spacing is of value.

Owing to the very dry conditions prevailing last summer, supplies of French bean [*Phaseolus vulgaris*] seed were very short, with the result that growers in areas where bacterial blight [*Bacterium medicaginis* var. *phaseolicola*: ibid., xv, p. 766; xvii, p. 577] is important, such as the Gosford, Wyong, and Far North Coast areas, may not be able to obtain clean seed. In these circumstances, spread must be restricted as much as possible by roguing.

HANSFORD (C. G.). **Report of the Senior Plant Pathologist.**—*Rep. Dep. Agric. Uganda, 1938–39* (Part II), pp. 28–29, 1940.

In this report [cf. *R.A.M.*, xviii, p. 575] the author states that during the period under review pot inoculations were made on B.P. 50 cotton, *Crotalaria juncea*, and *C. striata* [*C. saltiana*] with strains of *Verticillium dahliae* from a wide range of hosts, the inoculations being made into the soil of the pots, sterilized before planting. Almost all the strains gave infection on B.P. 52 cotton, which is known to be susceptible under field conditions at Bukalasa. Few infections resulted on *C. juncea* and *C. saltiana*, and a large proportion of the Uganda stocks of these plants are probably resistant. No constant morphological or biological differences between the strains of *V. dahliae* used were noted, the evidence indicating that the fungus has a wide host range. With B.P. 50 cotton, the incubation period ranges from about six weeks to late in the development of the plant.

Further cross-inoculation studies with strains of *Fusarium* of the *Elegans* section [ibid., xix, p. 342] demonstrated that the *Fusarium* isolated from naturally infected *C. juncea* is able to attack some plants of *C. saltiana*, though other individual plants are resistant, while the fungus isolated from natural infections of *C. saltiana* is able to attack *C. juncea*. Positive results on *C. juncea* were obtained by inoculations with *F.* strains from natural infections on cotton, *Sesamum indicum*, and chilli (*Capsicum frutescens*). A few infections were obtained on B.P. 50 with strains from widely different hosts, a fair proportion of plants of this variety being resistant to *Fusarium* attack.

In 1937, simsim [*S. orientale*] at Kampala suffered rather severe infection by *Rhizoctonia bataticola* [*Macrophomina phaseoli*]. The fungus was isolated in culture, but inoculation tests gave negative results. It is concluded that *M. phaseoli* is at most a very weak parasite of *S. orientale*.

Report of the Agricultural Department, Dominica, 1939.—17 pp., 1940.

The following items of interest occur on p. 9 of this report [cf. *R.A.M.*, xix, p. 134]. The average incidence of Panama disease [*Fusarium oxysporum cubense*] of bananas for all districts of Dominica in 1939 was 1·02 per cent. in 28,008 stools inspected at monthly intervals during 1940. So far, only one small plantation is known to be affected by *Cercospora* [*musae*], and drastic control measures have reduced infection to negligible proportions. No causal organism has

been found associated with black pod rot of vanilla and as the trouble has so far occurred only in dry years, it is thought that it may be of physiological origin.

CRAIGIE (J. H.). **The origin of physiologic races of rust fungi through hybridization.**—*Publ. Amer. Ass. Adv. Sci.* 12, pp. 66–72, [1940].

This is a review of recent developments in the knowledge of the origin of physiologic races of rusts through hybridization, with special reference to *Puccinia graminis* on cereals. Nearly all the papers included in the survey have been noticed from time to time in this *Review*.

PETERSON (R. F.) & LOVE (R. M.). **A study of the transference of immunity to stem rust from Triticum durum var. Iumillo to T. vulgare by hybridization.**—*Sci. Agric.*, xx, 11, pp. 608–623, 1940.

A series of experiments has been carried out at the Rust Research Laboratory, Winnipeg, in an attempt to transfer to *Triticum vulgare* the immunity from *Puccinia graminis tritici* possessed by *T. durum* var. Iumillo. The progeny from six crosses made by K. W. Neatby in 1930 to 1932, using Iumillo as one parent and Marquis, Hope, R.C. 729, Garnet, Marquillo, and Ceres as the others [*R.A.M.*, xi, p. 227; xii, p. 750], was multiplied and the resistant plants from the F_2 to the F_6 generations were selected for further study, the selected material comprising 48 *vulgare*-like lines of wheat and 2 *durum*-like lines possessing *vulgare* characteristics.

Repeated field tests under artificially induced epidemics involving many physiologic races of *P. g. tritici* showed all 50 lines to be immune or almost immune in the mature plant stage, even though most lines contained plants with abnormal chromosome numbers and behaviour.

In greenhouse tests of seedling reaction no line was immune from all nine races used, but 17 *vulgare* lines from five F_2 plants were immune from, or resistant to, all. The remaining 33 lines were susceptible to one or more races, but most were immune from, or resistant to, a number. On the whole, the lines were more resistant in advanced than in early stages of growth.

In the *vulgare*-like lines the chromosome numbers found were 38, 39, 40, 41, 42, and 43, while in the *durum*-like lines all the plants had 28. Approximately 40 per cent. of the plants examined cytologically had 42 chromosomes, and approximately 50 per cent. were heterozygous for the arrangement of one or more segments of chromosomes. Eighty-one relatively stable 42-chromosome plants were found, some of which have been used to establish re-selections for further work. Morphological studies demonstrated that many plants closely approached the *vulgare* type. The genes for the *vulgare* morphological condition were not found to be confined to the so-called C set of chromosomes.

The evidence indicated that the mature-plant immunity of one of the *vulgare*-like lines when crossed with other *vulgare* wheats is more simply inherited than that of Iumillo crossed with *vulgare*. In both cases inheritance appears to be more complex than that of the mature plant resistance of Hope or H-44 (*vulgare* derivatives of Marquis × Yaroslav Emmer) in intra-*vulgare* crosses.

It is concluded that the object of developing varieties of *T. vulgare*

with the immunity from stem rust of Iumillo has been closely approximated though not fully achieved.

MEHTA (K. C.). **Wheat and other cereals research. (i) Investigation of cereal rusts.**—*Rep. imp. Coun. agric. Res., Calcutta, 1938–9*, p. 7, 1939. [Received September, 1940.]

During the period under review further evidence was obtained of the over-summering of rusts in the uredo stage in the hills in India [*R.A.M.*, xviii, p. 511]. Black rust [*Puccinia graminis*] was found to survive the summer even at altitudes of 3,500 to 4,000 ft. in one locality in the North-West Frontier Province. In the plains yellow rust [*P. glumarum*] was observed generally during February, and brown [*P. triticina*] and black in March to April, while even earlier records came to hand of the appearance of the first-named in January and of *P. triticina* in February in the Punjab. No over-summering of rusts was reported from the hills of the Bombay–Deccan, but *P. graminis* developed in several districts in January and February. In the Nilgiris and Palni hills, rusts were as usual detected on the first (April- to June-sown) crop from July onwards, and by the end of August all three were present in profusion (60 to 100 per cent. in some fields) in the Nilgiris. In one region of Mysore *P. graminis* was observed early in December, and in another it appeared in the miniature plot on 21st January.

MEHTA (K. C.) & PAL (B. P.). **Rust-resistant Wheats for India.**—*Nature, Lond.*, cxlvi, 3690, p. 98, 1940.

Up to the present six races of black rust of wheat [*Puccinia graminis*] (including the virulent and widespread race 15), six of brown rust [*P. triticina*], and nine of yellow rust [*P. glumarum*] have been found in India [see preceding abstract]. The greatest obstacle to breeding for rust-resistant wheats has been the total lack of *vulgare* varieties resistant to the Indian races of *P. graminis*, but in experiments at the Agra College and at the Imperial Agricultural Research Institute, New Delhi, a batch of *vulgare* wheats received from the Director of Agriculture, Kenya, has shown promising resistance, and one of them, E. 144, proved highly resistant to races 15 and 40 and markedly resistant in the mature stage to all races of black rust; E. 148 was highly resistant in the seedling stage to all races of yellow rust. These varieties, though too late maturing and unproductive for direct cultivation in India, should prove invaluable for breeding.

BRIGGS (F. N.). **Linkage between the Martin and Turkey factors for resistance to bunt, Tilletia tritici, in Wheat.**—*J. Amer. Soc. Agron.*, xxxii, 7, pp. 539–541, 1940.

A recent re-examination, at the University of California, of the data from all the six wheat crosses involving the Martin and Turkey factors for resistance to bunt (*Tilletia tritici*) [*T. caries*: *R.A.M.*, xv, p. 351] revealed only 25 susceptible rows where 53·4 were expected out of a total of 854. Calculating the linkage between the Martin and Turkey factors for the entire population, a cross-over of 34·22 per cent. was obtained. On this basis the anticipated numbers for all crosses approximated much more closely to those actually secured than when the two factors

were considered independently. Out of 190 rows of Martin × Turkey 3055, 183 were resistant or segregating (these two classes could not be accurately separated), the corresponding figures for 183 Martin × Turkey 1558, 140 Sherman × Turkey 3055, 104 Martin × Oro, 118 Martin × Turkey 1558B, and 119 Martin × Turkey 2578 being 179, 136, 101, 114, and 116, respectively. With the exception of Martin × Turkey 1558, these numbers agree with those expected on the basis of the 15 : 1 ratio.

DÉFAGO (G.). **Influence de l'aneurine et de l'hétéro-auxine sur la croissance de trois parasites de Blé.** [The influence of aneurin and heteroauxin on the growth of three Wheat parasites.]—*Ber. schweiz. bot. Ges.*, xlix, pp. 413–414, 1939.

Preliminary results are described in an investigation undertaken to ascertain whether certain anomalies in the biology and parasitism of *Tilletia tritici* [*T. caries*] on wheat are explicable on the basis of the production of auxogenic substances by the host, *Cercosporella herpotrichoides* and *Ophiobolus herpotrichus*, which attack wheat at the base and roots, being used for comparison. Aneurin was found to be an indispensable factor in the growth of *T. caries* and *C. herpotrichoides*, the optimal concentrations being 0·2 γ and 0·4 γ per 25 c.c., respectively. *C. herpotrichoides* is capable of synthesizing thiazol but not pyrimidin, while neither of these components of aneurin contributes appreciably to the development of *T. caries*. *O. herpotrichus* (like *O. graminis*) failed to respond positively to vitamin B^1, high concentrations of which even tended to retard its growth. The development of both *T. caries* and *C. herpotrichoides* was delayed by indol-3-acetic acid at 1 and 150 γ per 25 c.c., respectively, *O. herpotrichus* being less sensitive to this factor.

TYNER (L. E.). **The effect of crop debris on the pathogenicity of cereal root-rotting fungi.**—*Canad. J. Res.*, Sect. C, xviii, 7, pp. 289–306, 2 figs., 1940.

In greenhouse experiments conducted from 1935 to 1939, the differential effect of wheat, barley, and oat straw on the development of the root rots of wheat caused by *Ophiobolus graminis*, *Fusarium culmorum*, and *Helminthosporium sativum* [cf. *R.A.M.*, xix, p. 11] was investigated. The straw was composted with soil and added to the pots in which inoculated and uninoculated (control) seedlings were grown. In general, the wheat straw composts were appreciably more conducive to the development of disease than those of either barley or oat straw, the latter being the least favourable. This is explained on the assumption that the dominant microflora of the oat straw composts is somewhat antagonistic to the pathogens, or characteristically different from that of the other two. Some evidence was obtained indicating that high concentrations of straw in a compost increased the severity of disease, but this effect was not very consistent in different plantings. The carbon to nitrogen ratio had apparently less effect than the chemical nature of the straw upon disease development. The artificial inoculum added to the pots was practically vitiated before the second crop; subsequently the *H. sativum* and *F. culmorum* infection tended to increase again, while *O. graminis* disappeared completely. Apparently the

conditions necessary for the rapid increase of *O. graminis* infection observed in the field were not provided in the greenhouse. Plants grown on wheat straw composts were, in general, the least, and those grown on the barley straw composts the most vigorous, while growth on oat straw composts varied. The vigour of plants grown on wheat straw composts was least at the highest concentration, while for barley straw the opposite was true. The differences in nitrate nitrogen content [cf. ibid., xix, p. 269] of the three kinds of straw were not directly proportional to the variations observed in plant vigour. The introduction of a short fallow period between plantings decreased the amount of infection somewhat and increased the vigour of the plants. The author concludes that the observed differences in persistence and virulence of the pathogen and in plant vigour were due chiefly to differences in the microflora associated with the various composts.

SALLANS (B. J.). **The relationship of weeds to losses caused by common rootrot in Wheat.**—*Sci. Agric.*, xx, 11, pp. 632–637, 1 graph, 1940.

In an experiment carried out in Saskatchewan in 1937 to test the effect of the inoculation of Reward wheat with *Helminthosporium sativum* on the development of other plants growing in competition with the crop, plots were sown with untreated wheat, inoculated wheat, wheat and flax, inoculated wheat with flax, and flax alone. At harvest, the plants were pulled, air-dried, and weighed, and the results showed that inoculation with *H. sativum* significantly reduced the yield of wheat and increased the yield of weeds. Competition from flax reduced the wheat and weed yields in both the uninoculated and inoculated plots, the yield of weeds being reduced significantly.

In a similar experiment in which the weeds used were *Chenopodium album* and *Amaranthus retroflexus*, there were significant reductions in dry plant weights of wheat resulting from inoculation, weeds, and the effect of interaction between the two. The yield of threshed grain, however, showed a non-significant increase due to inoculation, this result being associated with climatic factors. In 1939, both inoculation and weeds significantly reduced the wheat yields, but, in association with climatic factors, there was no significant interaction effect between the two treatments on yield.

It is concluded that *H. sativum* may retard wheat in the seedling stage, with the result that weeds become well established and, by impeding the tendency of the crop to throw off the infection, cause reduced yields of grain.

MIYAKE (M.). **Mendelian inheritance of the resistance against the virus disease in Wheat strains.**—*Jap. J. Genet.*, xiv, pp. 239–242, 1939. [Japanese. Abs. in *Jap. J. Bot.*, x, 4, p. (55), 1940.]

Nearly all the F_1 progeny of crosses between wheat strains susceptible and resistant to yellow and green mosaic [*R.A.M.*, xviii, p. 98] grown in seven types of soil known to be conducive to the development of the disease remained healthy, thereby affording proof of the dominance of resistance over susceptibility in regard to these viruses. In the F_2 the segregation into resistant and susceptible strains took place in the simple monogenic way.

TEAKLE (L. J. H.) & WILD (A. S.). **Some soil types associated with manganese deficiency of cereals in Western Australia.**—*J. Dep. Agric. W. Aust.*, Ser. 2, xvii, 2, pp. 223–233, 2 figs., 1940.

In this paper the authors describe the chief soil types found on a 1,000-acre farm in the wheat belt, east of Wagin, Western Australia. Some 25 per cent. of the area belonging to this farm consists of soil types in which wheat and oats show symptoms of acute manganese deficiency [*R.A.M.*, xv, p. 8; xviii, pp. 547, 733; xix, p. 522]. The principal soil type exhibiting manganese deficiency is the Tinkurrin gravelly sand. This has an ashy, powdery surface and an accumulation of ferruginous and quartz gravel in the subsurface layer. The subsoil is a yellowish-brown sandy clay loam showing further clay accumulation with depth. On this soil the application of manganese sulphate at the rate of 14 lb. per acre (applied mixed with superphosphate) resulted in normal crops of wheat, whereas on untreated soil manganese deficiency symptoms developed after a few weeks and grain formation was scanty.

TEAKLE (L. J. H.), TURTON (A. G.), & THROSSELL (G. L.). **Experiments on copper deficient land at Dandaragan, Western Australia.**—*J. Dep. Agric. W. Aust.*, Ser. 2, xvii, 2, pp. 161–173, 5 figs., 1940.

An experiment is described in which Burt's Early oats were grown in soil in the vicinity of Dandaragan, Western Australia, where cereal crops had repeatedly failed, the following treatments being applied, viz., (1) control, 1 cwt. superphosphate per acre, (2), (3), and (4) 1 cwt. superphosphate mixed with 5, 15, and 30 lb. copper sulphate, respectively, and (5) 1 cwt. superphosphate mixed with 15 lb. copper sulphate, 15 lb. manganese sulphate, 20 lb. magnesium sulphate, 20 lb. ferrous sulphate, 5 lb. zinc sulphate, and 5 lb. borax per acre. The crop was sown in May, and early in September most of the plants in the control plots were dead, while the remainder showed typical symptoms of copper deficiency. At harvest time all the copper-treated plots carried an excellent growth of oats [cf. *R.A.M.*, xviii, p. 547]. No yield was obtained from the control plots, while the hay yield per acre for each of the (2), (3), and (4) treatments was 3 tons 14 cwt., and for (5) 3 tons 16 cwt., the grain yields per acre being 45·5, 45·6, 50·7, and 49·2 bushels, respectively.

It is concluded that the crop failures on this land were due to copper deficiency, and that excellent crops may be produced on the soils in question if copper is applied as a fertilizer. Five pounds of copper sulphate mixed with superphosphate suffices, or even lighter applications may prove adequate. Soil analysis is an unsatisfactory guide to copper deficiency; the most certain method of detection consists in observation of the symptoms exhibited by an indicator crop. Farmers are recommended to experiment before undertaking extensive fertilizer dressings, as these are costly, and on some soils may depress yields.

In an appendix to this paper (pp. 173–177, 6 figs.) Miss J. M. Ford describes a preliminary anatomical examination of the oats grown on the control and treated plots. The most striking difference was in the relative degree of lignification of the copper-deficient and copper-treated plants. The stem of the former had a thin-walled epidermis, with thin-walled, unlignified cells in the cortex, and thin-walled cells

in the bundle sheath and pith, while the roots also showed lack of lignification of the walls. The leaves of the copper-deficient plants showed very little differentiation of the motor cells, small and compact mesophyll cells forming a rather palisade-like mesophyll, and usually few fibres; the cuticle was poorly developed. In yellowed or withered parts, the chloroplasts had disintegrated and the cell contents had changed to brown, tannin-like globules. The leaf hairs in copper-deficient plants were fewer and smaller than in the copper-treated plants and irregularly spaced; the root hairs were also more poorly developed in the former than in the latter.

Ling (L.). **Factors affecting spore germination and growth of Urocystis occulta in culture.**—*Phytopathology*, xxx, 7, pp. 579–591, 1 fig., 1 diag., 1940.

Chlamydospores of *Urocystis occulta* from rye at University Farm, St. Paul, Minnesota, germinated at a temperature range of 10° to 25° C., with an optimum at 15°, but not at 5° or 30° [*R.A.M.*, xvi, p. 666]. Solid media were found to be unfavourable to germination, neither did the spores germinate well in distilled or tap water or sugar solutions, but good growth was obtained in soil infusion. A stimulatory effect was exerted by benzaldehyde (3 : 2,000,000). Darkness or diffuse light were more conducive to germination than direct sunlight. The optimum hydrogen-ion concentration for spore germination was found to be about P_H 6·86; none took place at 3·80, but 5 per cent. of the spores germinated at 8·95.

U. occulta makes slow growth on artificial media, the colonies of monospore cultures attaining their maximum diameter of 45 mm. only after ten weeks. Sectors were commonly, but not abundantly, produced. The two haploid lines isolated from several hundred sporidial branches differed from the monospore lines in cultural characters and failed to infect rye, either singly or in combination. Monospore cultures grew on potato dextrose and malt extract agars at 5° to 25°, and on the former medium (the best of the solid substrata tested) with initial hydrogen-ion concentrations of P_H 5 to 9, the optimum being 6·2. Fair growth was supported by a number of carbohydrates, rhamnose and levulose excepted, the latter being actually toxic to the fungus. Phosphorus, nitrogen, and magnesium were indispensable mineral elements.

Chilton (St. J. P.). **Delayed reduction of the diploid nucleus in promycelia of Ustilago zeae.**—*Phytopathology*, xxx, 7, pp. 622–623, 1 fig., 1940.

At the United States Regional Pasture Research Laboratory, State College, Pennsylvania, young maize plants were repeatedly inoculated with cultures of *Ustilago zeae* arising from sporidia isolated from 158 chlamydospores produced by abnormal crosses between certain haploid lines of the smut, in which a high percentage of the promycelia disintegrated without forming sporidia. Both haploid and diploid sporidia were produced on the promycelia of three chlamydospores, in number one of which the first meiotic division was postponed to at least the second division of the diploid nucleus, and in numbers two and three to at least the third division [*R.A.M.*, xix, p. 527].

THOMAS (R. C.). **Additional facts regarding bacteriophage lytic to Aplanobacter stewarti.**—*Phytopathology*, xxx, 7, pp. 602–611, 1940.

In the course of studies on the bacteriophage lytic to *Aplanobacter stewarti* on maize in Ohio [*R.A.M.*, xiv, p. 503], the writer isolated from a number of cereals, grasses, vegetables, fruits, and ornamentals a non-specific 'phage precursor', inactivable by 30 minutes' heating at 56° C. On coming into contact with susceptible bacteria, this substance provokes a reaction resulting in the formation of a transmissible lytic principle which resists heating at 60° and is only partially inactivated at 65°. It is believed to be the origin of the bacteriophage in plants and to constitute a mechanism of resistance to disease. Wilt-susceptible maize varieties, such as Golden Bantam (seedlings), Golden Sunshine, Golden Evergreen, and Early White Market, were almost or wholly devoid of the 'phage precursor', which was strong, on the other hand, in the resistant Whipple's White, Stowell's Evergreen, Spanish Gold, Golden Colonial, and Country Gentleman. Several methods have been devised for freeing cultures of *A. stewarti* from its specific bacteriophage, Ivanoff's highly oxidizing medium [ibid., xiii, p. 299] being particularly valuable in this respect.

DE MELLO (I. F.). **Experimental studies on diets deficient in vitamin B and their influence on the intestinal yeast flora of animals.**—*Proc. Indian Acad. Sci.*, Sect. B, xi, 6, pp. 225–235, 1940.

A tabulated account is given of the writers' studies at Nova Goa, Portuguese India, on the relation between the yeast contents of animal (white rats, hens, rabbits, and pigeons) intestines and vitamin-deficient diets, an inquiry initiated with a view to determining the validity of the widely held blastomycotic theory of human sprue, attributed by Ashford to *Monilia* [*Candida*] *psilosis* [*R.A.M.*, ix, p. 454]. The animals were subjected to a beri-berigen régime of white polished rice, for which a normal diet was substituted on the appearance of B avitaminosis symptoms. A more or less abundant yeast flora [*Candida* and *Geotrichoides*: see next abstract] was found to occupy the intestinal tract of the experimental animals even in ordinary health, but the administration of a vitamin-deficient diet generally led to an increase in its numbers, which became intensified with progressive debility and gradually decreased to a normal level with the returning vigour conferred by suitable foods. These observations may possibly account for the development of levurotic complications in the case of patients suffering from weakness due to disease, exhaustion, or other factors.

DE MELLO (I. F.). **A report on the characters and identification of the yeasts living in commensalism in the intestine of some laboratory animals.**—*Proc. Indian Acad. Sci.*, Sect. B, xii, 1, pp. 17–28, 1940.

Of the seven types of yeast living in a state of normal commensalism in the intestine of certain domestic animals used in previous experiments on the effects of beri-berigenic diet [see preceding abstract], six were found to belong to *Candida* and the seventh to *Geotrichoides*.

De Mello (I. F.) & Viegas (J. De S.). **The phenomena of dissociation into S and R forms observed among the bacteria do also occur in yeast cultures.**—*Proc. Indian Acad. Sci.*, Sect. B, xii, 1, pp. 1–7, 4 figs., 1940.

The writers' studies [at Nova Goa, Portuguese India] on a strain (N3) of *Candida* isolated from the intestine of a white mouse and cultured on Sabouraud's agar revealed dissociation into smooth, rough, and intermediate types [*R.A.M.*, xix, p. 595 and preceding abstract]. The pronounced disparity between the smooth and rough forms of the *C.* strain under discussion is considered to be of great interest in connexion with the taxonomic classification of these medical fungi, a revision of which in the light of recent contributions to the subject is thought to be urgently required.

Meleney (H. E.). **Histoplasmosis (reticulo-endothelial cytomycosis): a review: with mention of thirteen unpublished cases.**—*Amer. J. trop. Med.*, xx, 4, pp. 603–616, 1940.

This review of 32 cases (13 as yet unpublished) of histoplasmosis (*Histoplasma capsulatum*) of man and animals [*R.A.M.*, xix, p. 595] is accompanied by a table showing the distribution of the disease by geographical location, age, sex, race, and organs affected. Three of the cases included in the survey were reported from the Panama Canal Zone, two from the Philippines, one each from Honduras, Java, Argentina, and Brazil, and the rest from different States of the American Union.

Dart (M. O.). **Otomycosis: treatment with silver picrate.**—*Arch. Otolaryng., Chicago*, xxxi, 6, pp. 885–910, 1 fig., 1940.

This is a comprehensive survey of the literature relating to otomycosis [*R.A.M.*, xix, p. 151] and its therapy, followed by a report of 25 cases investigated by the author in which the organisms concerned were species of *Monilia* [*Candida*], *Aspergillus*, *A. niger*, *Penicillium*, *Alternaria*, *Rhizopus*, and (?) *Trichophyton*.

MacCormac (H.). **Ringworm of the foot.**—*Brit. med. J.*, *1940*, 4139, pp. 739–740, 1940.

In the course of this survey of the clinical, diagnostic, and therapeutic aspects of ringworm of the foot in England, the author states that only two of the more than forty fungi once believed to be implicated in the etiology of the disease are now accepted as responsible agents, viz., *Epidermophyton inguinale* [*E. floccosum*] and *Trichophyton pedis* [*R.A.M.*, xvii, p. 818], the latter probably identical with *T. gypseum*. Various species of *Monilia* [*Candida*] may also be concerned in the development of vesicular eruptions and the patches of interdigital white skin indistinguishable from ringworm proper, but the pathogenicity of this group is of a low order and seems to require a special substratum, e.g., a moist, seborrhoeic skin, for profuse growth.

FLOR (H. H.). **New physiologic races of Flax rust.**—*J. agric. Res.*, lx, 9, pp. 575–591, 1940.

In addition to the 14 physiologic races of flax rust (*Melampsora lini*) [*R.A.M.*, xviii, p. 679] previously reported by the author from the United States (*J. agric. Res.*, li, pp. 819–837, 1935), ten new ones were identified in the present study, carried out between 1935 and 1938. In order to differentiate the new races, it was necessary to add three varieties, Argentine (C.I. 462), Bombay (C.I. 42), and Ottawa 770 B (C.I. 355), all of which were previously considered immune from rust, to the list of eight originally used differential varieties. Of the 201 varieties and strains of flax selected for testing because of their diverse morphologic type, commercial importance, or their reported resistance to, or immunity from, flax rust, all proved to be susceptible to one or more of the 24 races of the fungus that have been identified. Several strains of Argentine flax and Ottawa 770 B remained immune from all races collected in North America but were susceptible to one or more of the races from South America, while Bombay and J. W. S. were immune from races of South American origin and susceptible to one or more North American races. The results of pathogenicity tests seem to indicate that each of the varieties Argentine, Bombay, J. W. S., and Ottawa 770 B possesses distinct factors governing immunity from specific races of the rust. Of the 201 varieties tested, 48, 8, 4, and 20 reacted similarly to Argentine, Bombay, J. W. S., and Ottawa 770 B, respectively, to 16 physiologic races of the rust. It has been observed that the races of flax rust with a somewhat limited varietal range were predominant in the seed flax-producing areas of the Midwest over the races with a wider range.

PRASADA (R.). **Aecidial-stage of the rust of Linseed.**—*Curr. Sci.*, ix, 7, pp. 328–329, 1940.

In a study at the Agra College, India, from 1939 to 1940, successful germination of the teleutospores (nearly 60 per cent.) of the linseed rust, *Melampsora lini* [*R.A.M.*, xix, p. 583], one of the commonest diseases in some districts of the United Provinces and Bihar, was obtained in December from material kept in a refrigerator. All attempts to obtain germination from material stored in a room were unsuccessful. These results show that the teleutospores are viable at the time of their formation on the crop in the plains. When young leaves on seedlings of linseed, raised under rust-proof conditions in a greenhouse were inoculated with teleutospores, aecidia developed 13 days after inoculation, the average maximum and minimum temperatures during the period of the experiment ranging from 63·7° to 70·8° and 47° to 51° F. It is suggested that the absence of the aecidial stage in nature in the plains of India is due to the loss of viability of the teleutospores from exposure to very high temperatures after the harvest. Inoculations with the aecidiospores obtained in the above-mentioned experiment resulted in the development of uredo pustules. In inoculation experiments with uredo material collected from Cawnpore, Allahabad, and Pusa conducted simultaneously at Agra and at Simla, no infection could be obtained even in shade after the end of April at the former

locality, while at the latter the cultures kept well under natural conditions all through the summer and even survived the winter. These results are held to indicate that the uredo stage of the rust cannot stand the heat of the summer in the plains. The role of the teleutospores in the hills, however, is not yet clear and it is uncertain whether the rust starts afresh each year in those areas from over-summering uredospores or from aecidia, hitherto unnoticed.

MUSKETT (A. E.) & COLHOUN (J.). **Prevention of seedling blight in the Flax crop.**—*Nature, Lond.*, cxlvi, 3688, p. 32, 1940.

Seedling blight of flax (*Colletotrichum lini*) [*R.A.M.*, xviii, p. 315] is likely to assume greater importance in Northern Ireland if the cultivation of this crop and the home-saving of seed become more extensively practised. The pathogen is seed-borne, and the authors state that during the past two years a rapid and accurate technique has been evolved by the Plant Disease Division for the examination of flax seed samples for parasitic infection, and a sorting test has been devised for quick discrimination between promising and unsatisfactory seed fungicides. An experimental product submitted by Imperial Chemical Industries, styled R.D. 7846 and containing tetramethylthiuram disulphide as its active constituent, was found in preliminary tests to give very promising results against *C. lini*. It is a finely divided, apparently non-poisonous powder, and was used at the rate of 3 gm. per 500 gm. seed (approximately 5 oz. per bush. of 54–6 lb.).

Bericht der Eidgenössischen Versuchsanstalt für Obst-, Wein- und Gartenbau in Wädenswil für die Jahre 1935–1937. [Report of the Federal Experiment Station for Fruit-Growing, Viticulture, and Horticulture, Wädenswil, for the years 1935–7.]—*Annu. agric. Suisse*, xlv, 4, pp. 389–464, 1940.

In this report are included a number of items of phytopathological interest relating to the activities of the Swiss Federal Experiment Station for Fruit-Growing, Viticulture, and Horticulture for 1935–7, reference to some of which was made in this *Review* at the time of their publication in various journals. Mention may here be made of the following. A. Osterwalder and P. Camenzind tested a 0·5 per cent. formalin solution (or 1 in 80), 20 l. per sq. m., against *Sclerotium tuliparum* on tulips with satisfactory results, only 15 out of 87 bulbs in plots so treated on 13th October, 1936, and planted with bulbs on 3rd November becoming infected by the fungus up to April, 1937, compared with 52 out of 88 controls.

Versol, a grey-green, sulphur- and copper-containing dust manufactured by the Maag Chemical Factory, Dielsdorf, gave excellent control of rose rust (*Phragmidium* [*mucronatum*]) on the susceptible Eugen Fürst, Dr. G. Krüger, and Fisher Holms varieties, which were given eight applications between 12th June and 11th August, 1936. It was also effective against black spot (*Asteroma*) [*rosae*: *Diplocarpon rosae*] on bush roses.

Foot rot of aster (*Callistephus*) [*chinensis*] caused by a species of *Fusarium* or *Phytophthora* was well controlled by eight soil applications, between 10th July and 12th August, 1935, of either HBS soil

disinfectant (Kaufmann & Cie, Gränichen, Aargau), potassium permanganate, copper sulphate, or cupromaag, all used at a concentration of 0·001 per cent., the number of diseased plants being reduced from 39 in the untreated control to 1, 3, 5, and 8, respectively, in one set of beds and 8, 9, and 12 for the first three treatments, respectively, in another set.

MILLIKAN (C. R.). **Leaf scorch of Narcissus.**—*J. Dep. Agric. Vict.*, xxxviii, 6, pp. 307–308, 4 figs., 1940.

Leaf scorch disease of *Narcissus* caused by *Stagonospora curtisii* [*R.A.M.*, xix, p. 97], is recorded for the first time from Victoria, where it was observed on daffodils during the 1939 season. To reduce the spread of primary infection the bulbs should be immersed for one hour in water, and then for 30 minutes in mercuric chloride, 1 in 750 (approximately 1 oz. in 4¾ gals. water). Secondary infection from infected leaf tips may be checked by four or five applications of Bordeaux mixture 4–4–50 or 20–80 copper-lime dust, but the best control results from picking off infected leaf tips as they appear.

WALLACE (E. R.). **Use of disinfectants in the hot water treatment of Narcissus, 1936–38.**—*Rep. Bulb Exp., Kirton*, 7, pp. 43–56, 1940.

Rotting of narcissus bulbs by *Fusarium bulbigenum* is thought to be increased by dissemination of the spores of the fungus in the hot-water bath used for the control of eelworm. The disease has not been of any great economic importance in the Spalding area for the last nine years, but the author carried out experiments to ascertain the chemical effect of the addition of formalin on the bulbs [*R.A.M.*, xviii, p. 653]. The results obtained showed that formalin treatment increased the weight of the bulbs in five out of eight treatments in Golden Spur and Sir Watkin [daffodils]. The author recommends the use of 1 in 400 formalin as a fungicide; formalin 1 in 100 can safely be used when the bulbs are stored at a high temperature (about 80° F.) before the hot-water treatment, but where treatment in water alone is disadvantageous and where formalin 1 in 400 appears to prevent the injury, strong formalin is not advised.

JOHNSON (H. W.), LEFEBVRE (C. L.), & AYERS (T. T.). **Powdery mildew of Lespedeza.**—*Phytopathology*, xxx, 7, pp. 620–621, 1 fig., 1940.

Powdery mildew (*Microsphaera diffusa*) is stated to have caused premature defoliation of *Lespedeza* every year since 1935 at the Arlington (Virginia) Experiment Farm, occurring in 1938 in epidemic form, especially on *L. striata*, *L. stipulacea* being less susceptible, while *L. sericea* and an unnamed species, related to the last-named and *L. juncea*, are apparently immune.

GOULD (C. J.). **Diseases of cultivated Lupines.**—*Proc. Ia Acad. Sci.*, xlvi, pp. 119–125, 1940.

Of the diseases of cultivated lupins herein enumerated with brief descriptive notes, the following have been reported from the United States: stem necrosis (*Ascochyta pisi*), damping-off (*Rhizoctonia* [*Corticium*] *solani*), wilt (*Sclerotinia sclerotiorum* and *Thielavia* [*Thielaviopsis*] *basicola*), sore shin, *Botrytis cinerea*, *Erysiphe martii*, *Pythium de*

Baryanum, tomato spotted wilt, and two destructive wound parasites, *Collybia velutipes* and *Pleurotus ostreatus*, causing discoloration and decay of the wood within the stems of *Lupinus arboreus* (a valuable soil retainer on sand dunes in the San Francisco region), culminating in the partial or total death of the plants (*Phytopathology*, xi, pp. 389–404, 1921).

AGNEW (E. L.) & CHILDERS (N. F.). **The effect of two mild sulphur sprays on the photosynthetic activity of Apple leaves.**—*Proc. Amer. Soc. hort. Sci.*, xxxvii, pp. 379–383, 6 graphs, 1940.

Elemental sulphur fungicides are known to be less effective against apple scab (*Venturia inaequalis*) than lime-sulphur but have the advantage of causing practically no visible leaf injury. In experiments made at the Ohio Agricultural Experiment Station to study the effect of two mild sulphur sprays (the first consisting of 5 lb. sulfix, an elemental sulphur, and 3 lb. dry lime-sulphur per 100 gals. and the second of magnetic spray wettable sulphur, 8 lb. per 100 gals.) on the photosynthetic activity of apple leaves [*R.A.M.*, xviii, p. 685], it was found that little or no injurious effect was produced in this respect, except in one instance with the former material. In this experiment, reduced assimilation was associated with the highest maximum temperatures, 83° to 86° F., for the first three days after spraying. The reductions were 36, 16, and 15 per cent. on the first, second, and fourth days after spraying. After application of the magnetic spray sulphur, the daily temperature attained 88° on two days and was over 80° on six days. These results confirm the view that sprays containing sulphurs in suspension have less effect on the photosynthesis of apple leaves than sprays containing sulphurs in solution.

THIES (W. H.). **Effects of heavy applications of dusting sulfur on soil acidity and cover crop in an orchard.**—*Proc. Amer. Soc. hort. Sci.*, xxxvii, pp. 76–77, 1940.

The author states that the use of large quantities of dusting sulphur is causing a marked change in soil acidity in New England orchards. In a McIntosh apple orchard receiving about 1½ tons of sulphur per acre for 15 years the surface soil was very acid (from P_H 3·5 to 4·75) and only the most acid-tolerant plants could survive, but in spite of this the trees are vigorous and are cropping heavily. The soil should, however, be limed occasionally.

MACDANIELS (L. H.) & HILDEBRAND (E. M.). **A study of pollen germination upon the stigmas of Apple flowers treated with fungicides.**—*Proc. Amer. Soc. hort. Sci.*, xxxvii, pp. 137–140, 1940.

In studies carried out at Cornell University, Bordeaux mixture (2–6–100), copper-lime dust (20–80), and mike sulphur reduced but did not inhibit pollen growth on the stigma of apple flowers. Elgetol [*R.A.M.*, xix, p. 353] at 0·25 per cent. prevented pollen germination on the stigmas. Field trials indicated that the last-named material is highly promising for spraying when apple trees are in bloom to inhibit fruit set, an effective, non-injurious concentration being approximately 0·1 per cent.

HEINICKE (A. J.), BOYTON (D.), & REUTHER (W.). **Cork experimentally produced on Northern Spy Apples.**—*Proc. Amer. Soc. hort. Sci.*, xxxvii, pp. 47–52, 2 figs., 1940.

An experiment is described in which a healthy, 27-year-old Northern Spy apple tree that had borne disease-free fruits for many years, growing in Dunkirk silty clay loam was subjected to flooding in a basin about 40 ft. in diameter under the tree from August to November, 1938, and April to August, 1939. In June, 1939, the young fruits showed early symptoms of surface cork, and internal corky tissue in the flesh was also present. As the season advanced, scorch became pronounced, and many leaves developed bronzing, purpling, and other deficiency symptoms. Some of the older foliage turned yellow or brown and dropped. A high percentage of the severely corked apples failed to reach normal size, and many fell. Chemical analysis of the leaves showed a reduced percentage of ash in the dry matter, as compared with figures for non-flooded trees. The percentage of boron in the ash and the amount per leaf were lower than in the controls. The potash showed even greater reduction both in percentage of ash and amount per leaf, and the total nitrogen content was low. These results indicate that deficiencies of nutrients in the tissues are not necessarily due to deficiency of the elements in the soil. If soil conditions are such that the roots cannot function properly, especially if the oxygen content is low, nutrients are taken up in smaller quantities than normal.

MOORE (R. C.). **A study of the inheritance of susceptibility and resistance to Apple cedar rust.**—*Proc. Amer. Soc. hort. Sci.*, xxxvii, pp. 242–244, 1940.

In apple-breeding work carried out at the Virginia Agricultural Experiment Station the following information was obtained on the inheritance of susceptibility and resistance to apple cedar rust [*Gymnosporangium juniperi-virginianae*]. Analysis of records for a single year indicate that the factor for resistance or susceptibility was inherited and that there was a segregation of the progenies of crosses into resistant and susceptible types. It also appeared that resistance might be dominant over susceptibility. The Arkansas Black apple variety seemed to behave as a homozygous dominant for resistance, whereas Jonathan and Rome Beauty appeared to be homozygous recessives for susceptibility. Of the other parent varieties used in the crosses, Delicious, Rolls Seedling, Winesap, and Virginia Beauty, though phenotypically resistant, appeared to be heterozygous in resistance or susceptibility. Inheritance of resistance apparently involved only one genetic factor (though this was not finally established), and degree of susceptibility of parent varieties seems to manifest itself in the respective progenies.

DA LUZ (C. G.). **Notas sôbre a Botryosphaeria ribis.** [Notes on *Botryosphaeria ribis*.]—*Agron. lusit.*, i, 4, pp. 361–371, 1 pl., 1939. [English summary. Received May, 1940.]

Details are given of a series of inoculation experiments carried out at the National Agricultural Experiment Station of Portugal with pure cultures of *Botryosphaeria ribis* originally isolated from lemon trees

affected by gummosis in Madeira (*Rev. agron., Lisb.*, xxiv, pp. 124–134, 1936). As shown by previous workers, the size of the fructifications varies with the thickness of the infected bark, these organs being frequently unilocular in young twigs. The pycnospore dimensions varied from 11·7 to 19·5 by 4 to 6·2 μ on inoculated damson to 13·6 to 25·3 by 4·3 to 6·6 μ on pear. Macro- and micropycnidia were observed within the same stroma, and in a few cases macro- and micropycnospores occurred in the same pycnidium. A small number of pycnidia from the inoculated damsons were found to contain biseptate, hyaline, later light brown spores of the same shape and dimensions as the normal organs, which were also present. Subcultures from apple and damson on a slightly alkaline potato starch paste imparted a vivid pink coloration to the substratum after four days' growth.

HATTORI (S.) & KINOSHITA (S.). **Über Wirkstoffe, die von einem auf Prunus Hexenbesen erzeugenden Pilz Taphrina cerasi sezerniert werden.** [On the active substances secreted by the fungus *Taphrina cerasi* causing witches' broom on *Prunus*.]—*Bot. Mag., Tokyo*, liv, 638, pp. 58–63, 2 figs., 1940. [Japanese, with German summary.]

In a study on witches' broom of cherry (*Prunus yedoensis*), the action of ether extracts from pure cultures of the causal fungus, *Taphrina cerasi* [*R.A.M.*, vi, p. 427], on *Avena* seedlings was examined. For this purpose germinating *Avena* grains were placed on blotters soaked in saturated solutions of the extract diluted with water four or ten times. The root growth of the seedlings was strikingly retarded, whereas the growth of the coleoptile was apparently not affected. The *Taphrina* extract was shown to exert a more powerful effect on the roots than heteroauxin but had less effect on the coleoptiles than the latter. It is accordingly considered to be distinct from heteroauxin.

RASMUSSEN (E. J.). **The effect of several spray materials on the size, color, and per cent. solids of the fruit of the Montmorency Cherry.**—*Proc. Amer. Soc. hort. Sci.*, xxxvii, pp. 367–370, 1940.

In the last few years proprietary copper compounds have been developed which have proved more successful than lime-sulphur in the control of sour cherry leaf spot [*Coccomyces hemalis*: *R.A.M.*, xix, p. 199] in Michigan, and the value of these materials depends on the effect they produce on the physiological activity of the plant, as well as on their ability to control infection. The author describes experiments which showed that Montmorency cherry trees sprayed with Bordeaux mixture at concentrations of 4–6–100 and over gave cherries which were darker, smaller, and higher in total solids than those from trees sprayed with lime-sulphur. Trees sprayed with weak concentrations of Bordeaux mixture and with proprietary copper materials (including cupro-K, basicop, and coposil) produced cherries which were somewhat darker and were higher in total solids than cherries from trees sprayed with lime-sulphur, but were about the same size as the latter. Evidence was also obtained that the increased transpiration induced by Bordeaux mixture was responsible for the increased drought injury that occurred at East Lansing during the dry and hot season of 1939.

MURPHY (L. M.). **The effect of certain fungicides on the photosynthetic activity of Sour Cherry leaves.**—*Proc. Amer. Soc. hort. Sci.*, xxxvii, pp. 375–378, 1940.

The author presents experimental data demonstrating that in point of photosynthetic efficiency (as measured by the dry weight increment of the leaves) cupro-K is superior to coposil, Bordeaux mixture, and lime-sulphur as a spray for sour cherries against leaf spot (*Coccomyces hiemalis*) [see preceding abstract].

POTTER (J. M. S.). **Lessons from the Wisley fruit trials.—III. Yellow edge of Strawberries.**—*J. R. hort. Soc.*, lxv, 8, pp. 256–260, 1940.

In the official fruit trials at Wisley, healthy and fruitful stocks of all varieties of strawberries, free from yellow edge [*R.A.M.*, xix, p. 481], were maintained by the combined effect of the following methods. Varieties highly susceptible to the disease (including Aromatic, Campbell's Seedling, Redbourn, and Sir Joseph Paxton) were segregated from those showing no symptoms (including American Seedling, Corvallis, Duchess of Kent, Ettersberg 121, Huxley Giant, Oberschlesien, Pillnitz, and Tardive de Léopold) but carrying the virus in a masked form and being, therefore, potential carriers of infection. The two groups were planted separately on plots, isolated from one another by at least half-a-mile. It had been observed that as the plants grow older, an increasing number of runners succumb to yellow edge, and it was decided, therefore, to grow the plants for one year only, and propagate annually. Propagation was restricted to five runners for each plant and the planting distance was 18 in. between the plants and 2 ft. between the rows (2 ft. by 2 ft. 6 in. for Corvallis). Apart from these cultural measures, mites were controlled by spraying with lime-sulphur (1 in 30) at the end of March, nicotine being added if aphids were observed. One or rarely two more applications of standard nicotine wash against aphids might be necessary. After the fruit was gathered, dead foliage was removed and the plants sprayed again prior to layering the runners. Dusting with a nicotine dust (4 per cent.) proved effective in hot and dry weather only.

WARDLAW (C. W.). **Banana diseases. XIII. Further observations on the condition of Banana plantations in the Republic of Haiti.**—*Trop. Agriculture, Trin.*, xvii, 7, pp. 124–127, 5 figs., 1940.

A further visit to Haiti made eighteen months after the previous one in 1938 showed that the condition known as 'plant failure' of bananas [*R.A.M.*, xviii, p. 327] is present in an acute form in many areas, a majority of the plantations showing a preponderance of mediocre to poor fruit. In some localities the disease has become much aggravated since 1938, while in others the standard of production has declined. Most of the privately owned plantations round Cap Haitien and Plaine du Nord are now incapable of yielding fruit for export, owing to lack of irrigation, 'plant failure', and the presence of Sigatoka disease (*Cercospora* [*musae*: loc. cit.]) in its final epidemic form. In many instances the growers fail to appreciate the true causes of their failure.

The outlook for the banana industry in Haiti for the next few years does not warrant optimism. In descending order of importance the

main problems are (*a*) the economic solution of the problem of plant failure, (*b*) all-round improvement in cultivation, (*c*) control of *C. musae*, and (*d*) restricting the spread of Panama disease [*Fusarium oxysporum cubense*: loc. cit.]. The first two are both related to adequate production, without which the cost of controlling *C. musae* and meeting other contingencies cannot be met, and the author considers that until (*a*) is achieved it will remain inadvisable to attempt large-scale banana cultivation in Haiti.

New symptoms of 'plant failure' noted include destruction of the leaves, rotting of the leaf sheaths at the 'throat' or crown, and the dropping-out of bunches, resulting from failure of the softening petiole bases to give normal support. Affected plants also acquire a leaning position. That the destruction of the rootlet system is responsible for 'plant failure' may now be provisionally accepted. This destruction is probably due to some chemical factor.

Alkali chlorosis is still conspicuously present at Delugé and in small areas throughout the island; these unproductive places should be abandoned, though very good bananas may quite well be grown in the near vicinity.

A survey of the distribution and intensity of *C. musae* showed it to be in evidence everywhere, intensity ranging from light, general infection to very severe leaf scorching. In some areas the environmental conditions appear to delay the progress of infection or to reduce its intensity, but judging from the severity of the disease even in the more favoured localities it would seem that control measures will in time be necessary, at least during certain months. Treatment with copper-lime dust has proved moderately effective, but later on spraying with Bordeaux mixture or some other copper-containing material will probably become necessary. In certain private plantations near Cap Haitien and Plaine du Nord, where no control is practised (except for leaf pruning, which is ineffective) prematurely ripening bunches are evident and such fruit should not be used for export. Under present conditions it seems doubtful whether the cost of controlling *C. musae* will prove economically possible.

A minute brown spotting widely and profusely distributed on green leaves of Gros Michel bananas should be kept under observation.

Panama disease is definitely increasing in the Artibonite district, and a localized but severe outbreak was observed at Delugé. Near Jacmel the position is serious, and treatment appears to have been abandoned, though the conditions on the light alluvial soils in this locality favour spread.

'Moko' disease (*Bacterium solanacearum*) [ibid., xviii, p. 328] is widely distributed on the moko, bluggoe, or probon plantain in the Artibonite district.

Virus heart rot [loc. cit.] is prevalent. When the heart rot condition accompanying the leaf mottling is very marked, the plant is unable to yield commercial fruit, and the disease can be as destructive to the individual plant as is Panama disease. Infected stools should be eliminated by gas oil treatment.

Bananas in the Port-de-Paix area have shown a considerable amount of spotting or 'pitting' on the cushions and finger stalks, spotting dis-

tributed over the fingers, and lesions on the main stalk. The condition appears to be identical with 'pitting disease' associated in Brazil and Trinidad with various fungi, including *Piricularia grisea* [ibid., xvi, p. 195] and *Helminthosporium torulosum* [ibid., xix, p. 158].

MEHTA (P. R.). **Stem-end rot and soft rot of Pineapple in the United provinces.**—*Curr. Sci.*, ix, 7, p. 330, 1940.

Pineapple fruits purchased at the Cawnpore market showed the presence of stem-end rot, caused by *Ceratostomella paradoxa*, a fungus widely distributed in India, but where only once before (in 1939) has it been observed to attack this crop. The fruits came from the Gorakhpur district in the United Provinces, where the pineapple has been cultivated for the past few years. The symptoms are described and notes on control measures in other countries given.

RANJAN (S.) & JHA (V. R.). **The effect of ethylene and sulphur dioxide on the fruits of Mangifera indica.**—*Proc. Indian Acad. Sci.*, Sect. B, xi, 6, pp. 267–288, 1 pl., 13 graphs, 1940.

A detailed account is given of the authors' studies at the University of Allahabad on the physiology of black tip of mango in relation to ethylene and sulphur dioxide, two of the chief noxious constituents of the blast furnace gas used in brick kilns in the vicinity of the damaged fruits [*R.A.M.*, xviii, p. 329]. The respiratory rate was accelerated and the sugar content increased when the fruits were subjected to treatment with an ethylene-air mixture (1 : 1,000 dilution), the effects becoming noticeable after an induction period of not less than 15 hours, but the total acid content remained unchanged. The treated mangoes generally became soft and yellow. Protracted exposure to the ethylene-air mixture induced typical black tip symptoms (after 7 and 10 days, respectively, at 1 : 500 and 1 : 1,000).

Sulphur dioxide (1 : 1,000) also caused a gradual rise in the respiratory rate, and the treated mangoes underwent extensive disorganization, the mesocarp becoming pulpy, brownish, and malodorous.

Four mangoes placed in a chamber through which a mixture of air with 0·1 per cent. ethylene and 0·01 per cent. sulphur dioxide was passed developed distal blackening, the symptoms appearing on the sixth day and reaching a climax on the tenth.

BAKER (R. E. D.), CROWDY (S. H.), & MCKEE (R. K.). **A review of latent infections caused by Colletotrichum gloeosporioides and allied fungi.**—*Trop. Agriculture, Trin.*, xvii, 7, pp. 128–132, 3 figs., 1940.

In reviewing the progress of investigations on latent infection by *Colletotrichum gloeosporioides* [*R.A.M.*, xix, p. 294] and allied species, the authors state that numerous isolations of *C. gloeosporioides* made from grapefruit and papaws fell into three groups: (1) those with orange-pink conidial masses and little or no aerial mycelium, (2) those with fewer, more irregular conidia, dark stromatic growths, and more aerial mycelium, and (3) those producing the perithecia and asci of *Glomerella cingulata* [ibid., xi, p. 382] in culture. While all 'species' of *Colletotrichum* producing *G. cingulata* as the perfect stage must be

regarded as strains of this organism, many isolations of *C. gloeosporioides* never produce setae in culture, and only occasionally form them in natural media on old lesions; in all other respects, however, they are identical with *Gloeosporium musarum*, and doubtless the two species are frequently confused. Isolations indistinguishable from *C. gloeosporioides* were made from cacao, and it seems clear that the cacao anthracnose species, including *C. incarnatum* [ibid., v, p. 159], *C. theobromae*, *C. theobromicola*, *C. luxificum* [ibid., xiv, p. 566], and *C. cradwickii* [ibid., xi, p. 701] require further investigation. It may be that anthracnose of many tropical fruits is due to strains of *Gloeosporium* and *Colletotrichum*, all of which belong to *Glomerella cingulata*.

Experiments demonstrated that *C. gloeosporioides* germinates slowly in pure water, but that germination is accelerated if a nutrient is added to the infection drop. The conidia were highly sensitive to atmospheric humidity, germination being virtually inhibited at relative humidities under 95 per cent. On slides over calcium chloride the spores were no longer viable after about 70 hours. When mango fruits were inoculated with conidial suspensions an initial period with relative humidity at or near saturation point was essential for infection, but it was not necessary for this period to persist for more than 12 hours, provided the fruits were not immediately subjected to abnormally dry conditions. On full green papaws infections were established after 24 hours in a saturated atmosphere, while on young fruits heavy infections were established only after 42 hours, light infections occurring after 12. When a young fruit was inoculated with a suspension of spores in 2 per cent. malt, low infection occurred after 12 hours and heavy after 18. Appressoria developed equally quickly on young and old fruits. Young mango fruits became infected as readily and as rapidly as old papaw fruits, but old mangoes were less readily infected, their behaviour corresponding closely to that of young papaw fruits. On mangoes infection reached maximum intensity when the fruit was about half developed, and then declined [ibid., xix, p. 611].

It is concluded that the question of stomatal or cuticular penetration still requires elucidation, that the rate of exosmosis of nutrients from fruit of different ages appears to be important, and that the nature of the resistance of young papaws and old mangoes should be studied. The fact that latent infection is able to develop further when the fruit begins to ripen or reaches a certain stage of senescence is assumed to be due to chemical changes in the fruit tissues.

NATTRASS (R. M.). **Further notes on the 'woodiness' disease of Passion Fruit in Kenya.**—*E. Afr. agric. J.*, vi, 1, p. 54, 1940.

In the Sotik district of Kenya, woodiness disease of passion fruit shows different symptoms from those observed in Trans Nzoia [*R.A.M.*, xix, p. 107]. In the former locality, the foliage remains almost unaffected, or in severe cases is affected only for a very brief period, though the effect on the fruit is well marked. Affected vines occur sporadically throughout a plantation. Fruits on a single dropper only may be attacked, and woody and normal fruits may be found on the same dropper. Occasionally, only one side of the vine is affected. The

whole fruit may be distorted, with large swellings, corresponding to areas of woody tissue, or it may be reduced to a small, spherical mass of hard, woody tissue, the internal cavity having almost completely disappeared. One of the earliest signs of attack is the presence of one or more round, yellowish spots, up to ¼ in. in diameter, on the surface of the green fruit; these spots are difficult to cut, and indicate the position of the woody tissue.

Attempts to transmit the Sotik form of the disease by inoculating healthy seedlings with juice and crushed tissue from affected plants failed, though the Trans Nzoia type was readily transmitted by this method. When, however, cuttings from affected vines at Sotik were grown on their own roots at Nairobi they produced woody fruit and the disease was successfully transmitted to two healthy vines by inarching, and from these vines again to others by the same method. The evidence indicates that the Sotik disease is also caused by a virus, but is less readily transmissible than the Trans Nzoia type, and is probably not spread on the workers' hands or on pruning knives. Few plantations are, however, completely unaffected.

To control the Sotik type of woodiness it is recommended that directly a plantation comes into bearing it should be frequently inspected and all affected vines destroyed, the gaps being promptly replanted. Seedlings for replanting should be raised in a distant, isolated spot. Seed from woody fruits produces healthy plants.

Horsfall (J. G.), Heuberger (J. W.), Sharvelle (E. G.), & Hamilton (J. M.). **A design for laboratory assay of fungicides.**—*Phytopathology*, xxx, 7, pp. 545–563, 1 diag., 3 graphs, 1940.

A detailed account is given of co-operative studies at the Connecticut, Minnesota, and New York (Geneva) Agricultural Experiment Stations on the possibilities of a refinement in the existing methods of the laboratory appraisal of fungicides [*R.A.M.*, xviii, p. 754], using as a test organism *Macrosporium* [*Stemphylium*] *sarciniforme*, a pathogen of red clover (*Trifolium pratense*), which at 20° C. readily forms large, black spores with hyaline germ-tubes on oat agar.

In order to convert precise concentrations of a given fungicide into equally precise deposits on the treated surface a precision sprayer is required, with a de Vilbiss atomizer No. 15 nozzle. The target, consisting of a 3 by 1 in. glass microscope slide, coated with cellulose nitrate, was fixed at the opposite end of a cylinder 30 by 4 in., the spray stream thus enclosed undergoing no deflexion by stray air currents. Since the spray tended to evaporate and lose its load of toxicant at low air humidities, the cylinder was placed inside a hood where the dew point could be controlled by varying the humidity. The deposit of spray fluid on the slide per unit of time was regulated by changing the size of the hole in the atomizer end of the tube. It was necessary to maintain a constant distance between the target and the atomizer and the atomizer and the level of spray in the container since deposition varied inversely with these distances, while the spore concentration was held constant at 5,000 per c.c. by the use of a haemocytometer. A Breed eyepiece micrometer was found to facilitate counting.

It is necessary to determine the resistance level of the test spores to a standard Bordeaux mixture. For example, exposures of 3, 5·5, and 8 seconds gave deposits of 0·096, 0·176, and 0·256 mg. copper per sq. cm. sprayed surface, with spore inhibition percentages of 8, 35, and 57, respectively. The LD 50 (lethal dose for 50 per cent. of the spores) [ibid., xvii, p. 540] or resistance level in this experiment was at 0·221 mg. per sq. cm., or 0·00039 mg. per spore.

The preparation of the standard LD 50 Bordeaux is described and a coefficient calculated to measure the relative fungicidal value of the test material, namely, the quotient obtained by dividing the quantity of copper in Bordeaux necessary to give LD 50 by the quantity of copper in the unknown essential for the same purpose. The Bordeaux coefficient provides a correction for oscillations in the resistance level of the spores and enables the investigator to compare materials tested on different days.

HOWARD (F. L.). **The value of testing fungicides in the laboratory before use in the field.**—*Proc. Amer. Soc. hort. Sci.*, xxxvii, pp. 409–414, 1940.

For evaluating the efficiency of potential fungicides [see preceding abstract] the author adopted the methods developed by McCallan, using glass slides. In addition tests were also carried out on living leaves as a substratum. The fungi used in the tests were chiefly peach brown rot (*Monilinia* [*Sclerotinia*] *fructicola*) and tomato early blight (*Alternaria solani*). The result of the tests recorded showed that commercial brands of 'dry' Bordeaux mixture and of some 'insoluble' copper fungicides differed widely in their toxicity to *S. fructicola*, but all, when used at the dilution recommended by the manufacturers, were less toxic than Bordeaux mixture; at double strength, some were approximately as effective as Bordeaux mixture. Liquid lime-sulphur (2–100) was less toxic to *S. fructicola* than Bordeaux mixture. Two commercial brands of dry lime-sulphur showed widely different toxicity to the fungus. In tests with *A. solani* the toxicity of Bordeaux mixture appeared to be sharply reduced when the dilution was greater than 5–5–50. Some 'dry' Bordeaux mixtures did not materially reduce spore germination. Malachite green and some other organic dyes at great dilutions were strongly fungicidal to spores of *A. solani*.

The results showed that reputedly similar commercial fungicides may vary in toxicity. The author considers there is need for the establishment of biological standards of toxicity in addition to the statement of chemical composition.

WEBER (A. L.) & MCLEAN (H. C.). **The effect of lime and weathering upon lead arsenate and copper spray mixtures.**—*Proc. Amer. Soc. hort. Sci.*, xxxvii, pp. 391–396, 1940.

In laboratory experiments on the effect of lime and weathering upon lead arsenate and copper spray mixtures (including cupro-K, basicop, coposil, ZO, copper hydro, and Bordeaux mixtures), it was found that lead arsenate usually reduces the water-solubility of the copper in the mixtures, but in the case of cupro-K and Bordeaux mixture 2–1–50 it is increased, while no effect is evident with Bordeaux mixtures 1–3–50,

1–4–50, and 2–2–50. The effect of lime on water-soluble copper varies according to the type of copper compound and to the presence or absence of lead arsenate. With coposil and copper hydro, the addition of lime causes a large increase in water-soluble copper but in others lime caused a decrease in soluble copper. As a rule copper compounds have a tendency to decrease the solubility of the arsenate. When a film of mixture was exposed to the atmosphere for two weeks, the presence of lime caused a much larger increase in water-soluble arsenic than occurred in its absence, a result due to the carbonization of the lime. Only in the case of cupro-K was there no increase in the water-soluble copper in the absence of lime. These results indicate that it is not the original content of water-soluble copper and arsenic but the effect of the atmosphere that causes the heavy metals of the spray mixture to change to an injurious form.

Burkholder (C. L.), Hienton (T. E.), & Reed (M.). **Ten years of operation cost records on stationary spray equipment.**—*Proc. Amer. Soc. hort. Sci.*, xxxvii, pp. 401–403, 1940.

In comparative tests during 1930, 1931, 1933, and 1934 the cost of spraying apples with a portable sprayer was $1·50, 0·73, 0·76, and 0·70 per 100 gals. spray, respectively, the cost including labour, power, interest on investment, and depreciation, but not materials, the corresponding costs for spraying with stationary spray equipment being $1·30, 0·70, 0·50, and 0·56 per 100 gals. In 1935, the area sprayed hitherto with portable apparatus was fitted with stationary plant and the application cost reduced to 36 cents per 100 gals., the corresponding cost in 1936, 1937, 1938, and 1939 being 55, 38, 41, and 40 cents, respectively, an average for the five-year period of 42 cents. In another orchard a stationary spray plant serving 200 acres gave over a nine-year period a corresponding figure of 26⅔ cents.

Bruno (A.). **A new formula for a copper mixture.**—*C. R. Acad. Agric. Fr.*, xxvi, pp. 454–457, 1940. [French. Abs. in *Chem. Abstr.*, xxxiv, 15, p. 5236, 1940.]

The following formula is stated to produce a much more readily dispersible mixture than those prepared with milk of lime or sodium carbonate: dissolve 1 kg. copper sulphate in 50 l. water and 1,250 to 1,300 gm. sodium orthophosphate in 20 to 30 l., make up to 100 l., and stir.

Hoffman (C.), Schweitzer (T. R.), & Dalby (G.). **The effect of chlorine substitution on the fungistatic properties of acetic and propionic acids.**—*J. Amer. chem. Soc.*, lxii, 4, pp. 988–989, 1 graph, 1940.

Tests were carried out at the Ward Baking Company, New York, to determine the effect of chlorine substitution on the toxicity of acetic and propionic acids to [food-contaminating] fungi [*Aspergillus niger*, *A. glaucus*, *Rhizopus nigricans*, and *Penicillium frequentans*: *R.A.M.*, xix, p. 296]. β-chloropropionic acid has a fungistatic curve practically identical with that of propionic acid itself and differing markedly from the β-iodopropionic acid curve. The introduction of chlorine on the

alpha carbon atom of propionic acid sharply reduces its fungistatic properties. Monochloracetic acid is also much less effective than acetic except in the very high P_H ranges. A chlorine atom on the carbon atom adjoining the carboxyl group thus affects the fungistatic properties of an acid, whereas the same substituent on a beta carbon atom has no influence.

The relative fungistatic properties of acetic and monochloracetic, and of propionic and α-chloropropionic acids, when compared with their respective dissociation constants, are in agreement with the widely held theory that the biological activity of an acid is dependent on the dissociation constant. This relationship is not so close, however, in the case of propionic and β-chloropropionic acids, which exert essentially identical fungistatic effects with dissociation constants of $1{\cdot}33 \times 10^{-5}$ and $8{\cdot}59 \times 10^{-5}$, respectively.

Brown (W.). **Plant disease in relation to the public.**—*Nature, Lond.*, cxlvi, 3691, pp. 118–121, 1940.

This is a report of a Chadwick Public Lecture delivered by the author on 20th June, 1940. He discusses in popular terms various, chiefly economic, aspects of plant disease and indicates lines on which further progress in disease control is to be sought.

White (D. E.). **The chemistry of fungus and bacterial pigments.**—*Aust. chem. Inst. J. Proc.*, vi, 8, pp. 313–330, 1939.

This is a critical, fully documented survey of outstanding recent contributions to the study of the pigments produced by micro-organisms. The characteristics of the various products are briefly described, and notes are also given on the relatively few bacterial pigments known up to the present.

Price (W. C.). **Comparative host ranges of six plant viruses.**—*Amer. J. Bot.*, xxvii, 7, pp. 530–541, 6 diags., 1940.

The experiments described in this paper were started on the assumption that a comparison of the host ranges of several plant viruses might lead to a knowledge of the specific chemical or physical properties required by the viruses for reproduction. Plants belonging in a large number of families were tested for susceptibility to six different viruses and the results are tabulated on pp. 531–536. It was found that tobacco necrosis virus [*R.A.M.*, xviii, pp. 540, 555; xix, p. 370] infected 88 species in 37 families but failed to infect 25 species in 13 of these and 28 species in 20 others; tobacco ring spot virus infected 143 species in 40 families but failed to infect 14 species in 13 of these and 21 species in 16 others; tomato ring spot virus infected 54 species in 35 families but failed to infect 17 species in 12 of these and 29 species in 20 others; cucumber mosaic virus infected 191 species in 40 families but failed to infect 21 species in 12 of these and 25 species in 19 others; cucurbit mosaic virus [cucumber virus 4: ibid., xvii, p. 647] infected 5 species in one family but failed to infect 107 species in 52 other families; and lucerne mosaic virus [ibid., xix, p. 563] infected 92 species in 28 families but failed to infect 16 species in 12 of these and 43 species in 28 others. These results indicate that conditions requisite for the multiplication

of the virus in the plant tissue is a characteristic of the species itself and has little or no relationship to the taxonomic position of the family. The only exception among the viruses tested seems to be cucumber virus 4, which has a very narrow host range, being restricted to certain species in the Cucurbitaceae.

LEA (D. E.). **Determination of the sizes of viruses and genes by radiation methods.**—*Nature, Lond.*, cxlvi, 3691, pp. 137–138, 1940.

A radiation method for the determination of the size of the virus particle and other biological entities of subcellular size is described, based on the results of previous work, in which it was found that a particle of virus or phage can be inactivated by exposure to ionizing radiation such as X-rays, α-rays, or β-rays [cf. *R.A.M.*, xix, p. 370]. It was seen that the dose of radiation needed for inactivation corresponds to one ionization in a volume equal to the volume of the virus particle, and furthermore, that the inactivation is of the nature of a single unit process. The results of some preliminary experiments with X-rays showed that the value for the diameter of the virus of tobacco necrosis determined by radiation (14 to 19 mμ) was in good agreement with the value deduced from ultrafiltration experiments (12 to 20 mμ) [cf. ibid., xv, p. 672].

TIMONIN (M. I.). **The interaction of higher plants and soil microorganisms. I. Microbial population of rhizosphere of seedlings of certain cultivated plants.**—*Canad. J. Res.*, Sect. C, xviii, 7, pp. 307–317, 1 fig., 2 graphs, 1940.

In greenhouse experiments in Canada with seedlings of wheat, oats, lucerne, and peas, it was found by the use of the plating method that the number of bacteria and Actinomycetes was 7 to 71 times greater in the rhizosphere of these plants than in the soil distant from the roots [*R.A.M.*, xix, p. 488]. In the case of fungi the increase was not considerable, only 0·75 to 3·1 times, but this is possibly due to the discrepancies of the plating method when applied to fungi. Generally, fungi were more numerous in the rhizosphere of oats, and bacteria in that of lucerne. Seventeen genera of fungi were represented in isolates from the rhizosphere and soil distant from the roots, including *Aspergillus niger*, *A. versicolor*, *Coniothyrium fuckelii* [*Leptosphaeria coniothyrium*], *Fusarium* spp., *Gliocladium roseum*, *Mesobotrys* spp., various species of *Penicillium*, and *Spicularia terrestris* n.sp., the last-named from the rhizosphere of lucerne. There was no significant difference in the fungal population isolated from the rhizosphere of the different plants, or between the rhizosphere and the soil distant from the roots.

HAMADA (M.). **Physiologisch-morphologische Studien über Armillaria mellea (Vahl) Quél., mit besonderer Rücksicht auf die Oxalsäurebildung. Ein Nachtrag zur Mykorrhiza von Galeola septentrionalis Reichb. f.** [Physiological and morphological studies on *Armillaria mellea* (Vahl) Quél., with special reference to oxalic acid formation. An addendum to the mycorrhiza of *Galeola septentrionalis* Reichb. f.]—*Jap. J. Bot.*, x, 4, pp. 388–463, 1 pl., 8 figs., 4 diags., 3 graphs, 1940.

The development of nine strains of *Armillaria mellea*, including

three symbionts of *Galeola septentrionalis* and one of *Gastrodia elata* in the Kyoto district of Japan [*R.A.M.*, xix, p. 35], was found to proceed most actively on nutrient decoctions, especially soy sauce agar, while the secretory reactions were powerfully stimulated by synthetic media, such as glucose-peptone agar.

A. mellea in nature and on nutrient media gives rise to two types of rhizomorphs: (*a*) a flat, wrinkled, mostly white form, *Rhizomorpha subcorticalis*, and (*b*) a smooth, cylindrical, and more or less black form, *R. subterranea*. In addition, somewhat friable 'brown membranes' composed of one or two superficial, brown, sclerenchymatous cell layers and some underlying white ones are formed on the surface of the media and can be considered a form of *R. subterranea* [ibid., xiii, p. 483]. The development of rhizomorphs and brown membranes was found to depend largely on the nitrogen (peptone): carbon (glucose) ratio of the substratum, attaining a maximum at 1 : 4. Secretory reactions influenced by this factor are luminescence, guttation, and calcium oxalate crystal production, the two first-named being most in evidence at 1 : 1 and the last-named at 1 : 4. Yeast agar media favour the development of the *R. subterranea* type of rhizomorph, while the *R. subcorticalis* form [loc. cit.] is produced by soy sauce agar. The possibility that these media contain growth substances stimulating the distinctive forms of development associated with them is briefly discussed, and in this connexion the virtual inability of *A. matsutake* [ibid., xv, p. 684] to grow on soy sauce is mentioned as pointing to a more complex relationship between growth-promoting and growth-inhibiting factors than would appear from Fries's work [ibid., xviii, p. 335].

The various strains under observation fall into certain definite categories characterized by rhizomorph formation, aerial mycelium production, luminescence, and so forth. The fact that the symbionts of *G. elata* and *Galeola septentrionalis* possess the characters of *A. mellea* in varying degrees is regarded as a further argument in favour of their wholesale inclusion within the species.

The shapes of the calcium oxalate crystals produced in culture or on the hyphae are largely dependent on the quantities of peptone added to the medium, pyramidal structure resulting from an abundance and prisms from a shortage of this substance.

Evidence is adduced that the symbiont is unable to lead an entirely normal and independent existence even in the 'fungus-host layer' (the outer root cortex), its movements being governed to a very considerable extent by seasonal variations in the activity of the host.

COCKERHAM (G.). **Virus diseases and seed Potatoes.**—*Advanc. Sci.* (*Quart. Rep. Brit. Ass., 1939*), i, 2, p. 313, 1940.

Since the introduction in 1932, by the Department of Agriculture for Scotland, of a scheme whereby virus diseases are taken into consideration in grading potato crops for seed purposes, a steady improvement in the health of Scottish stocks has resulted. Nevertheless, virus diseases still continue to harass the Scottish seed potato industry, a particularly serious problem being the ubiquity of potato virus X [*R.A.M.*, xviii, p. 408]. This virus is independent of insect vectors for dissemination, and the environmental advantages for potato seed production

offered by the greater part of Scotland do not come into play. Consequently a large acreage of potatoes has to be graded H, which in the absence of virus X would have been graded A. It is suggested that the replacement of varieties tolerant to this virus by intolerant or 'field-immune' ones may provide a solution to the problem.

SILBERSCHMIDT (K.). **Progressos e projetos em torno da produção de tuberculos-sementes de Batatinha em S. Paulo.** [Progress and plans in respect of the production of Potato seed tubers in S. Paulo.]—*Biologico*, vi, 7, pp. 173–179, 4 figs., 1940.

Particulars are given of the progress to date and future plans in regard to the scheme already described for the production of virus-free seed potatoes in Brazil [*R.A.M.*, xix, p. 234, where the country was given in error as the Argentine and the indigenous stocks (l. 43) referred to were Argentine stocks]. The project is organized on a co-operative basis by some 30 growers with properties situated at an altitude of 1,000 m. or above in the region of São João de Bôa Vista. About half the seedlings raised from the 2,000 boxes of Eigenheimer and Bintje seed imported from Holland developed unmistakable symptoms of virus infection, necessitating drastic roguing and convincing the farmers of the urgent need for the establishment of plantings for the production of indigenous seed stocks. In this connexion the methods adopted in various countries for the realization of this object are described and their application to local conditions discussed.

JONES (L. K.), VINCENT (C. L.), & BURK (E. F.). **The resistance of progeny of Katahdin Potatoes to viroses.**—*J. agric. Res.*, lx, 9, pp. 631–644, 5 figs., 1940.

In further variety trials on the resistance of potatoes to virus diseases [*R.A.M.*, xvi, p. 828], veinbanding or Y virus was found to reduce the tuber yields of the U.S.D.A. 46000, Earlaine, and Houma varieties by 75, 58, and 72 per cent., respectively, in the second season following 100 per cent. infection by the virus, and that of Katahdin only by 5 per cent. None of the seedling lots showed immunity from mechanical inoculations with the Y virus; some were completely susceptible and others somewhat resistant. Some resistance was consistently exhibited by seedling lots grown from seed of which Katahdin was a parent. Katahdin selfed seedlings showed 54 per cent. resistance, but higher resistances were obtained by crossing Katahdin with Ackersegen, Imperia, Sebago, and U.S.D.A. 41956. The results of field tests showed that mechanical inoculation with the Y virus in the greenhouse, although it appears to indicate the relative susceptibility of seedling lots, does not record the limit of their susceptibility since greater susceptibility was observed from natural infection in the field. Only seedlings having Katahdin as a parent showed resistance to veinbanding in the field, this resistance being insignificantly increased by crossing Katahdin with other varieties. When potato tubers were planted in the same planting with seedlings, many varieties became 100 per cent. infected with veinbanding in two years, while seedlings 46842 and 47208 showed none, Katahdin showed 12·9, and several other varieties less than 32 per cent. infection. The results of tests with single-drop tubers showed that selfing Earlaine or

crossing it with Katahdin or U.S.D.A. 41956 gave seedlings of reduced resistance to the Y virus as compared with those obtained from selfing Katahdin or crossing it with No Blight or U.S.D.A. 41956. Observations on the seedlings grown in the greenhouse from seed collected from veinbanding-affected plants failed to give any indication that the Y virus is seed-transmitted.

A serious disease appeared in the potato planting in 1938 and 1939, characterized by dwarfing and erectness of the plants, rolling, harshness, and reddening of the foliage and increase in the number of tubers. Healthy tomato scions grafted on affected potato plants developed typical symptoms of tomato curly dwarf caused by the beet curly dwarf virus to which the potato disease is attributed. There was no significant difference in varietal susceptibility to the virus, although there was some indication that possibly Katahdin and its progeny were more susceptible than other varieties.

Plants of Rural New Yorker No. 9 and seedlings from crosses of Early Northern × McCormick and Irish Cobbler × Keeper were susceptible to mechanical inoculation with tobacco mosaic virus, while all the other varieties tested, including Katahdin and its crosses, were immune. Selfed Katahdin seedlings were susceptible to infection by the tobacco mosaic virus through grafts with mosaic-affected tomato scions, but the virus was not transmitted through tubers collected from affected plants. Katahdin was immune from infection by mechanical inoculation with the X virus from Russet Burbank and Green Mountain, but was susceptible to a variant of the virus from Potato Seedling 2277.

Esbo (H.). **Potatisens degenerationsjukdomar.** [Potato degeneration diseases.]—*Medd. Frökontrollanst. Stockh., 1940*, 15, pp. 63–70, 1940. [German summary.]

Notes are given on the symptoms, economic importance, time of appearance, incidence, agent, equivalent foreign names, and mode of transmission of the potato virus diseases, mild mosaic, crinkle, aucuba mosaic, streak, and leaf roll, followed by a discussion on control by the use of clean seed and varietal selection. Magnum Bonum, Erdgold, and Gloria are most widely affected by mild mosaic, Frühgold, Juli, Erdgold, and Gloria by crinkle (King Edward invariably suffering from paracrinkle), and Marius, Sharpe's Express, Prof. Maercker, Blenda, Aal, Voran, Up-to-Date, and Erstling [Duke of York] by streak. [The above-mentioned diseases are not explicitly stated to occur in Sweden.]

Cordner (H. B.) & Ward (N.). **Germination and decay of Potato sets and tubers in controlled studies with special reference to high soil temperatures.**—*Proc. Amer. Soc. hort. Sci.*, xxxvii, pp. 874–878, 1940.

As a result of experiments on the storage of Triumph potatoes at temperatures of 70° to 95° F. it has been found that the so-called seed-piece decay of autumn-sown Irish potatoes in Oklahoma at high soil temperatures is not at first a true pathological rot but a physiological disturbance. Treatments favouring oxygen penetration of the tissues, such as cutting the tubers, generally favoured germination at high temperatures, while others which tended to limit the gaseous exchange

encouraged seed-piece decay. Prompt sprouting, especially of whole tubers, reduced breakdown and increased germination. The longer the tubers or sets remain in the soil at high temperature the more likely they are to disintegrate without sprouting. The similar protective value of 'pre-sprouting' against decay caused by a species of *Fusarium* has already been established (McMillan, *J. agric. Res.*, xvi, pp. 279–304, 1919). It is concluded that newly cut sets should prove more satisfactory than whole tubers for autumn crop plantings locally, which are made when soil temperatures are much above the optimum. In spring plantings at lower soil temperatures, however, whole tubers are less subject to decay. As an explanation of their apparently contradictory behaviour it is pointed out that the initial breakdown in the autumn planting develops from within the tubers, whereas in spring planting the causal agent is found in the soil exterior to the tuber.

MÜLLER (A. S.). **La marchitez y podredumbre de Papas causadas por Sclerotium rolfsii Sacc.** [Potato wilt and rot caused by *Sclerotium rolfsii* Sacc.]—*Agricultor venez.*, iv, 45–46, pp. 19–20, 1940.

Sclerotium rolfsii is stated to have caused a reduction of 50 to 90 per cent. in the anticipated potato yield in the Aragua and Carabobo valleys of Venezuela in 1939. The symptoms of the disease are briefly described and improved cultural measures for its control indicated.

SAWADA (K.). **Rice blast disease and manuring 2–9.**—*Agric. Rep. Formosa*, xxxv, pp. 22–31, 111–118, 182–189, 251–259, 383–387, 444–449, 655–656, 1937. [Japanese. Abs. in *Jap. J. Bot.*, x, 4, pp. (62)–(63), 1940.]

Of the three essential fertilizers, nitrogen, phosphate, and potash, only the first named was found in the course of several years' observations in Formosa to affect markedly the development of rice blast [*Piricularia oryzae*: *R.A.M.*, xix, p. 429]. The incidence of infection rose parallel with additional amounts of nitrogen, which induced a decline in the thickness of the leaves and of their epidermal cell walls, coupled with an increase in the number and size of the stomata. Similar abnormalities were detected in the histological structure of the culm nodes, which also underwent a diminution of the sclerenchymatous tissue and a corresponding extension of the soft parenchyma. All these factors naturally impair the resistance of the plants to infection by *P. oryzae*. Before the earing leaves are damaged, the panicles sustain injuries involving a reduction of grain size and extensive sterility.

MURRAY (R. K. S.). **Report of the Botanist and Mycologist for 1939.**—*Rep. Rubb. Res. Bd, Ceylon, 1939*, pp. 48–71, 1940.

In this report [cf. *R.A.M.*, xix, p. 114] the author gives, *inter alia*, the results of field trials of four brands of dusting sulphur against *Oidium* [*heveae*: ibid., xviii, p. 816] on rubber. The brands containing 90 to 95 per cent. sulphur gave the best control, one brand was unsatisfactory, and the fourth, an inexpensive product, was found to have excellent physical and cloud-forming properties largely on account of inert bituminous matter contained in it. This inert matter may prove to be of value in enhancing the adhesive properties of pure sulphur.

The chief fungi found in 1939 on *Hevea* rubber plants killed by root disease in Ceylon were *Fomes lignosus* and *Poria hypobrunnea*, of which the latter was the less common. Maximum loss occurred in the second or third year after planting, after which the fungi concerned appear to become quiescent, even where old infected roots remain in the ground. Reports from estates systematically examining the roots of every plant at periodic intervals showed that the cost ranged from 1·25 to 4 rupees [1*s.* 10½*d.* to 6*s.*] per acre per round. Plants showing an external growth of the fungus, but no penetration of the tissues, are treated by rubbing off the mycelium and swabbing with copper sulphate solution; such plants were found to be quite healthy after four to nine months.

The available evidence indicated that the deterioration and death of covers of *Pueraria phaseoloides* over large areas under mature rubber was due to soil sickness, such as is commonly associated with leguminous crops grown continuously in the same soil. The remedy consists in rotation, and estates have been advised to establish other legumes, to encourage non-leguminous weeds, and to apply fertilizers containing phosphate to healthy covers.

Light, overhead shade was found to give a substantial degree of control of *Helminthosporium heveae* [ibid., xix, p. 115]; spraying with perenox [ibid., xix, p. 260] was also satisfactory in this respect.

FRIEND (W. H.). **The crow-bar method of applying soil correctives, plant nutrients, and disease inhibiting chemicals about the roots of horticultural plants.**—*Proc. Amer. Soc. hort. Sci.*, xxxvii, pp. 1080–1083, 1940.

The author draws attention to the possibility of correcting nutritional disorders of plants by using relatively small amounts of chemicals applied in holes punched or bored in the soil surrounding the plant. One pound of material applied in holes within the root zone can be more effective than 5 lb. or more broadcast over the surface soil. The number, depth, and spacing of the holes and the materials used depend on the type and age of the plants, the nature of the soil, and the object of the treatment. In the author's experiments a pointed iron bar made from the drive shaft of a motor truck was found to be effective for punching the holes. The materials may be applied in liquid or granular form; liquid treatment appears to be desirable in treating plants affected with root disease, where prompt action is called for. On very calcareous soils the corrective chemical (such as copperas) should be used with a fixation inhibitor such as sulphur or an acid-forming fertilizer. The evidence also showed that it is desirable to use materials (such as sewage sludge) providing food for the bacteria that expedite the oxidation of the sulphur into sulphuric acid, which is a very effective inhibitor of fixation, a powerful soil solvent, and a preventive of certain soil-borne diseases. In a test on 25 papaw plants, the application of activated sludge plus sulphur to holes resulted in the loss of only one plant from root rot (*Phymatotrichum* [*omnivorum*]), whereas application of sludge without sulphur to a large block resulted in 29 per cent. infection. The data obtained demonstrated that relatively small amounts of materials, applied in acidulated spots or cores, are able to correct a type of chlorosis that is prevalent on the calcareous soils of the Rio Grande delta.

MARTIN (J. P.) & WAKSMAN (S. A.). **Influence of microorganisms on soil aggregation and erosion.**—*Soil Sci.*, l, 1, pp. 29–47, 1940.

This is a full account of the writers' studies on the part played by micro-organisms in soil aggregation and erosion, a preliminary note on which has already been noticed in this *Review* [*R.A.M.*, xix, p. 115].

NIETHAMMER (ANNELIESE). **Der Einfluß eines Schwefelkohlenstoff-Präparates auf typische mikroskopische Bodenpilze.** [The influence of a carbon disulphide preparation on typical microscopic soil fungi.]—*Zbl. Bakt.*, Abt. 2, cii, 1–3, pp. 20–24, 1940.

In connexion with her studies on soil micro-organisms at the German Technical College, Prague [*R.A.M.*, xix, p. 566], the writer carried out three series of experiments to determine the effects of a proprietary carbon disulphide preparation on pure cultures of *Trichoderma koningi* [*T. viride*], *Penicillium expansum*, *P. bicolor*, *Fusarium oxysporum*, and *Cladosporium herbarum* in dishes containing 30 gm. steam-sterilized garden soil in a dark chamber at 20° to 23° C., the chemical being applied at the rate of 0·8 gm. per dish (160 gm. per sq. m.). All the fungi gradually ceased growth and eventually died off as a result of the treatment. Used at half the normal strength, the compound tended to stimulate the growth of the three first-named fungi and failed to influence the other two in either direction. The introduction into the dishes of substantial amounts of finely ground cabbage roots and leaves counteracted the fungicidal effects of the carbon disulphide, which exerted only a temporary check on the growth of the micro-organisms.

In dishes containing both a pure culture of *P. expansum* and 50 turnip seeds, only 24 of the latter germinated and their roots were damaged, whereas in those to which carbon disulphide was applied 48 seedlings developed normally. Similar results were obtained with *F. oxysporum*.

ARRUDA (S. C.) & DESLANDES (J.). **A murcha do Mamoneira do nordeste.** [Castor wilt in the north-east.]—*Biologico*, vi, 6, pp. 143–148, 1940.

The species of *Fusarium* responsible for the castor [*Ricinus communis*] wilt previously recorded from São Paulo, Brazil [*R.A.M.*, xvii, p. 65] is stated to have been identified by H. W. Wollenweber as *F. orthoceras* var. *ricini* n. var., further studies on the morphological and physiological characters of which are in progress. [No diagnosis of the variety is given.] In the north-east of the country the crop also suffers from the same disease (20 per cent. infection in a block of plantings at the junction of the rivers Grande do Norte and Potenji), as well as from another form of wilt associated with a collar and root rot caused by *Rhizoctonia* [*Corticium*] *solani*. Soil inoculation tests with sorghum seed or cassava flour cultures of *F. orthoceras* var. *ricini* gave positive results on dwarf and giant varieties of castor after an incubation period of 22 days, the fungus being reisolated from the petioles and stems. Under favourable conditions for the development of the pathogen, such as are afforded by the north-eastern climate, the percentage of mortality may be expected to range from 68·8 to 82 per cent.

Pontis (R. E.). **El 'marchitamiento' del Pimiento (Capsicum annuum) en la provincia de Mendoza.** [The 'wilt' of Chilli (*Capsicum annuum*) in the province of Mendoza.]—*Rev. argent. Agron.*, vii, 2, pp. 113–127, 2 pl., 1 fig., 1940. [English summary.]

A detailed, tabulated account is given of an investigation, in progress since 1935 and still continuing, on chilli wilt in Mendoza, Argentine Republic. The disease is characterized by drooping, a pale chestnut-coloured discoloration and death of the foliage, dark chestnut, sunken lesions at the shoot bases, with shrivelling and blackening of the cortex, and darkening of the tap- and lateral roots, the cortical tissues of the former being disorganized. Infection occurs in a plantation in scattered groups, the extent of which gradually increases as the season advances: an attack in early spring prevents fruiting and involves the complete destruction of the crop.

From the diseased roots and shoots were isolated on 2 per cent. glucose and broad bean agar *Fusarium vasinfectum* [*R.A.M.*, xviii, p. 89], *F. solani*, and its var. *martii*, of which only the first-named gave positive results in soil inoculation experiments at 27° C. on seedlings raised from sterilized seed. The pathogen grew very slowly at 16°, but developed rapidly between 23° and 31°, with an optimum at 26° to 28°, the maximum for growth lying above 32°. The mean soil temperatures in December, January, February, and March for 1936 to 1939 were 20·8°, 27·6°, 24·7°, and 22·7°, corresponding to which infection became established in the plantations in January and reached a climax in February (in the north of the province). The highest percentage of wilt (58·5) from 1936 to 1938 occurred in soil with an average moisture content at a depth of 0·2 m. of 14·7 per cent., resulting from irrigation at four-day intervals, the incidence at 12 per cent. (16-day intervals) being only 20 per cent.

Satisfactory control of the disease was obtained in three years' experiments by the adoption of Garcia's furrow-ridge method, as applied to the similar disorder of chilli due to *F. annuum* in New Mexico [ibid., xiii, p. 420.]

Bitancourt (A. A.). **As doenças da Cana de Açucar no Brasil.** [Sugar-Cane diseases in Brazil.]—*Biologico*, vi, 6, pp. 137–143, 1940.

This is a summary of the literature on sugar-cane diseases in Brazil, grouped under the headings of virus, root and stem, and foliar, accompanied by a table showing the reactions to mosaic of the different varieties grown in the country, and followed by a bibliography of 22 titles [*R.A.M.*, xviii, p. 624].

Zamora (J. C.). **El mosaico de la Caña de Azucar.** [Sugar-Cane mosaic.] —*Agricultor venez.*, iv, 45–46, pp. 15–18, 2 figs., 1940.

Mosaic being the most serious disease of sugar-cane in Venezuela [*R.A.M.*, xiv, p. 397], a semi-popular account is given of its symptomatology, etiology, economic importance, mode of transmission, and control, based largely on the investigations of M. T. Cook and F. S. Earle, with a view to assisting growers in the work of eradication.

HIRATSUKA (N.). **Japanese species of Gymnosporangium.**—*Bot. & Zool.*, vii, pp. 748–749, 1939. [Japanese. Abs. in *Jap. J. Bot.*, x, 4, p. (41), 1940.]

Eleven species of *Gymnosporangium* are enumerated for Japan [*R.A.M.*, xvi, p. 411]. An analytical key is given for their identification, and the synonymy, hosts, and distribution of each species cited.

GADD (C. H.). **'Bitten-off' disease of Tea seedlings.**—*Tea Quart.*, xiii, 2, pp. 54–58, 3 figs., 1940.

'Bitten-off' disease of tea [*R.A.M.*, xviii, p. 729] is one of the most destructive conditions affecting certain nurseries in Ceylon. The first symptom is the unthrifty appearance of the plants, the leaves being crowded together and the older ones falling prematurely. Later on, growth ceases, the leaves drop, and the bushes die. By the time the state of the tea has been noticed, the finer roots and most of the taproot have disappeared. The transference to roots of healthy seedlings of fungi, including a species of *Rhizoctonia*, isolated from roots of affected tea, invariably failed to reproduce the disease.

To ascertain what part might be played by excess of water in conducing to bitten-off disease, tea seedlings were grown in pots in (1) a very wet, but not waterlogged soil, (2) a waterlogged soil, and (3) a wet, but not waterlogged soil. After three months the plants in lot (3) had made fair growth, while those in (1) and (2) were unthrifty and showed root decay, i.e., they exhibited symptoms of bitten-off disease. Field examination, however, demonstrated that excess of water was not the only cause of the condition.

Other experimental evidence clearly showed that tea does not tolerate a neutral or alkaline soil, and that such soils of themselves cause bitten-off disease. This conclusion was fully confirmed by numerous chemical analyses of soil samples, and explains why the disease is so often found in nurseries on old building sites, where mortar and lime rubble have become incorporated in the soil. The excessive use of wood ashes from domestic fires and from tea-driers is a frequent cause of deterioration in soils used for tea.

GADD (C. H.). **Report of the Mycologist for 1939.**—*Bull. Tea Res. Inst. Ceylon* 21, pp. 31–37, 1940.

In this report [cf. *R.A.M.*, xviii, p. 713] the author states that phloem necrosis of tea [ibid., xix, p. 120] has now been definitely identified from 103 estates in Ceylon, the distribution of which suggests that the disease occurs throughout the tea-growing districts at elevations above 4,000 ft.; it has been found in very few localities below this elevation. Between November, 1936, and July, 1938, 25 affected bushes from different estates were transplanted among healthy tea at St. Coombs, but the change of site did not lead to recovery, though none of the healthy bushes have so far developed any symptoms of necrosis. Three bushes before transplanting showed the disease in parts only, and no spread occurred subsequently in these. The experiment indicates that while a change of soil and climate does not assist recovery, the disease is not readily transmitted, and spread through a bush may be very slow.

Some young tea bushes were killed by *Leptothyrium theae* [ibid.,

xviii, p. 822], and one old bush was killed, after collar-pruning, by the same fungus.

Armillaria mellea was observed for the first time on *Tephrosia vogelii*, grown among tea, while the same host was also affected, on another estate, by *Ustulina* [*zonata*]; *T. vogelii* appears, therefore, to be susceptible to all the common root diseases of tea.

Very few reports of leaf fall of *Grevillea* [*robusta*] trees due to *Phyllosticta* [cf. ibid., xviii, p. 822] were received, but in the Uva district this host was affected by a die-back of the upper branches, developed after a period of drought.

Fifty-second Annual Report of the Kentucky Agricultural Experiment Station for the year 1939. Part I.—63 pp., [1940].

The following items of interest occur in this report [cf. *R.A.M.*, xviii, p. 576]. During 1939, wildfire [*Bacterium tabacum*: ibid., xix, p. 617] caused extensive damage in untreated beds in western Kentucky, often killing over 50 per cent. of the plants. Beds sprayed with Bordeaux mixture were in most cases unaffected. Of 279 untreated beds examined, 79 and 86 showed wildfire and angular leaf spot [*Bact. angulatum*], respectively, while of 207 treated beds 2 showed wildfire. Of 47 fields set from untreated beds the losses from these diseases at cutting time were as follows: 1 per cent. in 21 fields, 5 to 10 per cent. in 15, 15 to 20 per cent. in 8, 25 per cent. in 2, and 50 per cent. in one. No damage occurred from either disease in fields set from treated beds.

Black shank [*Phytophthora parasitica* var. *nicotianae*] appeared on four farms near Adairville and on an adjoining farm in Tennessee. The disease had been present on one of these farms in 1935, and had been carried to the others by drainage water; it destroyed over 32 per cent. of the plants on one farm, and half-an-acre of tobacco on another.

Mosaic caused greater damage to dark tobacco than wildfire and angular leaf spot. The burning type was present and destructive in many fields, and some fields were cut green because the growers confused the disease with wildfire. That the mosaic continues to be so destructive emphasizes the need for the development of resistant varieties. Strains of mosaic-resistant dark field tobacco from crosses with Ambalema grown in 1939 by two commercial growers showed high resistance in the field, coupled with a satisfactory type of growth. Twenty-nine strains of Burley tobacco derived by hybridization with mosaic-resistant Ambalema and back-crossing with Burley once or more on the F_2 resistant selections were tested in the field, each plant being inoculated four times with white and yellow mosaics. Of the strains tested 25 developed no sign of mosaic except chlorosis or necrosis at the inoculation sites. Some of the strains showed excellent growth type and quality. By continued back-crossing on the necrotic spotting progeny of a fertile *Nicotiana glutinosa* × *N. tabacum* hybrid (Ternovsky), strains of Burley tobacco were developed indistinguishable from the commercial type, except that they carry the necrotic spotting factor which generally localizes the virus in the inoculated leaves. A strain homozygous for the necrotic spotting factor was isolated which was rather more variable in plant characters than the original variety.

Fusarium wilt [*F. oxysporum* var. *nicotianae*: ibid., xvi, p. 658] is

becoming increasingly destructive to Burley tobacco in the sandy areas of Kentucky. Inoculation tests showed that one variety was resistant not only to this disease, but also to black root rot [*Thielaviopsis basicola*] and mosaic.

Blue mould (*Peronospora tabacina*) [ibid., xix, p. 619] occurred first on plants almost ready to set. The disease has caused so little damage during the past three years that the only control measure necessary will probably be to use new beds in unshaded places.

Naghski (J.), Haley (D. E.), & Reid (J. J.). **Seed-bed sterilization and Tobacco wildfire.**—Abs. in *J. Bact.*, xl, 1, pp. 168–169, 1940.

Suspecting an increased prevalence of tobacco wildfire [*Bacterium tabacum*] in seed-beds sterilized with steam for the purpose of combating the organism in Pennsylvania [*R.A.M.*, xviii, p. 553], the writers examined samples of soil steamed (*a*) in the autumn and (*b*) in the spring previous to sowing and (*c*) untreated. Glucose-peptone-agar was used for fungal counts, nutrose agar for bacteria and Actinomycetes, and crystal violet-asparagin-mineral salts broth for the green-fluorescent bacteria [*Pseudomonas fluorescens*]. All the samples yielded every type of organism specified, *P. fluorescens* being most numerous in spring-steamed soils. Serological tests showed that 75 per cent. of the green-fluorescent organisms from steamed soils and 60 per cent. from the untreated were identical with known cultures of the agent of wildfire. It is obvious from these results that recommendations for steam sterilization of the soil as a means of controlling wildfire are misleading.

Smith (K. M.). **The Tomato and the cigarette.**—*J. R. hort. Soc.*, lxv, 8, pp. 243–244, 1940.

As a result of inquiries into cases of virus diseases of tomato recently reported by growers to the Virus Research Station, Cambridge, it was found in every case that persons in charge of the tomato plants either smoked cigarettes or chewed tobacco while tending the plants. In one instance the virus causing a severe yellow mosaic of the tomato crop was isolated from a sample of the local cigarettes smoked by the gardener. It is pointed out that the virus of tobacco mosaic, which causes mosaic and stripe in tomato plants, remains infective in processed tobacco, and gardeners are therefore warned not to smoke while tending the plants and to wash their hands carefully with soap and hot water before starting work [cf. *R.A.M.*, vii, p. 124].

Nelson (R. M.). **Vigorous young Poplar trees can recover from injury by Nectria cankers.**—*J. For.*, xxxviii, 7, pp. 587–588, 1940.

Young yellow poplar [*Liriodendron tulipifera*] stands in the southern Appalachians are liable to infection by a species of *Nectria* [? *N. galligena*] responsible for the so-called 'target canker' [*R.A.M.*, xiv, p. 407], and in order to settle the question of the importance of the disease in relation to crop selection, a plot was established for study purposes in 1933 in the Bent Creek Experimental Forest, North Carolina, consisting of 15- to 20-year-old, 35 ft.-high trees, of which 60 were measured for canker diameter, length, and width, and bole circumference at the widest part of the canker, and classified as of poor, medium, or good

vigour, and of over-topped, intermediate, or codominant and dominant crown classes.

In 1938 the following data were obtained in respect of mortality and healing: of the 28 trees of poor vigour, 68 per cent. were dead and 7 per cent. healed, the corresponding percentages for trees of medium and good vigour being 8 and 68 and 0 and 86, respectively. Of the 21 trees in the over-topped crown class, 76 per cent. were dead and 7 per cent. recovered, the corresponding percentages for the intermediate being 19 and 25 and for the codominant and dominant 9 and 83, respectively.

A marked difference was observed in the growth rates of trees with healed and open cankers, the average basal increment of the former at the end of five years being 153 per cent. compared with only 42 per cent. for the latter. The average diameter increases of healed and unhealed trees were 1·32 and 0·34 in., respectively.

All the trees under observation bore at least one canker and 13 had from two to four cankers each, ranging from 0·7 to 23 by 0·6 to 3·8 in. The average amount of cankered circumference in 1933 was 33 per cent. for trees that lived and 48 per cent. for those that died.

It is apparent from these data that infected dominant or codominant trees of at least moderate vigour may be selected with reasonable safety as crop trees.

Buchanan (W. D.). **Scolytus sulcatus Lec. transmits Dutch Elm disease fungus under controlled conditions.**—*J. econ. Ent.*, xxxiii, 2, pp. 250–251, 1940.

Scolytus sulcatus occurs in parts of New York, Connecticut, and New Jersey, apple being probably its preferred host, though breeding takes place in elm, plum, peach, and mountain ash [*Pyrus* (?) *americana*]. The beetle has been found in elms attacked by *Ceratostomella ulmi*, and the fungus isolated from insects found in and issuing from elm material collected in the field. Under controlled conditions at the Bureau of Entomology and Plant Quarantine, United States Department of Agriculture, beetles artificially contaminated with *C. ulmi* inoculated elm and apple trees, the former also contracting infection when fed upon by insects issuing from diseased elm wood. These experimental results do not of course prove that *S. sulcatus* is actually concerned in the transmission of *C. ulmi* in nature, the extent of the insect's implication in the spread of the disease remaining purely conjectural pending further studies.

Felt (E. P.). **European Elm bark beetle and Dutch Elm disease control.**—*J. econ. Ent.*, xxxiii, 3, pp. 556–558, 1940.

A consideration, in the light of the past six years' experience, of the various aspects of the Dutch elm disease (*Ceratostomella ulmi*) [*R.A.M.*, xix, p. 624] control problem in relation to the depredations of the elm bark beetle (*Scolytus multistriatus*) in the eastern United States has convinced the writer that the incidence of the insect is mainly local and that it is largely confined to diseased or dying wood. The normal limit of flight suggests that there would ordinarily be no extensive invasion from neighbouring territories. The immense production of beetles in

New Jersey in 1937, for instance, did not materially increase the number of infected trees in New York in 1938. The author considers that the data to hand, though admittedly inconclusive, indicate the possibility of local control by means of two to three relatively inexpensive midsummer prunings and the immediate burning of weak wood.

HARDY (M. B.), LUTZ (H.), & MERRILL (S.). **A preliminary report of Pecan leaf scorch studies.**—*Proc. Amer. Soc. hort. Sci.*, xxxvii, pp. 489–492, 1940.

In this preliminary report of studies on pecan leaf scorch the authors state that the condition is marked by the development of necrotic areas on the basal edges of the leaflets. These lesions do not enlarge much before the leaflet falls. The leaflets first affected are generally those at the base of the basal leaves. As the condition progresses the basal leaves fall and the trees may become almost completely defoliated. The disease may appear when the leaves reach full size or later, but it generally appears early rather than late. The Desirable, Moore, and Stuart varieties are much more seriously affected than most of the others commonly grown. Data are presented which indicate that an increase in the water supply or a decrease in the rate of water loss through transpiration reduces significantly the incidence of leaf scorch. Observations show that the condition is severe in years of low rainfall, and in soils with low water-holding capacity and fertility. The degree to which a variety or an individual tree is affected varies with the season, soil, cultural practice, and fruiting, and may be such as to cause complete loss of crop and extensive dying of the shoots.

JACKSON (L. W. R.). **Effects of H-ion and Al-ion concentrations on damping-off of conifers and certain causative fungi.**—*Phytopathology*, xxx, 7, pp. 563–573, 3 graphs, 1940.

Studies were conducted by the Division of Forest Pathology, Bureau of Plant Industry, in co-operation with the Allegheny Forest Experiment Station and the University of Pennsylvania, on the effect of the hydrogen- and aluminium-ion concentrations of the medium (a sodium glycerophosphate solution containing ferric citrate and other mineral compounds) on the damping-off disease of conifer seedlings and on the growth of the causal organisms (*Pythium*, including ? *P. ultimum*) and *Rhizoctonia* [*Corticium*] *solani* [*R.A.M.*, xvii, p. 281].

The amount of growth produced by the *P.* isolates from *Pinus aristata*, Douglas fir [*Pseudotsuga taxifolia*], and sugar beet was nil at P_H 2·5 and 3·5, rose to a maximum at 5·5 and 6·5, and fell to zero again at 8·5 in all the series except one. In the absence of sugar chlamydospore and oospore production was less profuse at P_H 4·5 than at 6·5. The *C. solani* strains from red pine [*Pinus banksiana*] and Douglas fir failed to grow at P_H 2·5, developed slightly at 3·5, considerably more at 4·5 to 6·5, and fell off again at and beyond 7·5. Sclerotial production was nil at P_H 3·5 and 4·5, increased at 5·5 and 6·5, and fell to zero again at 7·5 and 8·5. The incidence of damping-off in *P. ponderosa* and Douglas fir in liquid cultures was lowest at P_H 2·5 and 3·5, reached a peak at 6·5, or less frequently at 5·5, and then decreased. In quartz sand cultures the relationship between the hydrogen-ion concentration

of the medium and damping-off was less consistent than in the liquid, except that there was a low incidence in all the series run at P_H 2·5.

Aluminium exerted a barely significant beneficial effect on damping-off in sand cultures at P_H 3·5 at a 0·0005 M. concentration of aluminium sulphate. Both with and without aluminium the damping-off percentages were higher at P_H 6·5 than at 3·5.

The hydrogen-ion concentration of P_H 2·5 was practically the lower limit for the host roots in both liquid and sand cultures; growth was excellent from 3·5 to 6·5, while a falling-off in development was also noticeable at 7·5 and 8·5. The maximum aluminium sulphate concentration of 0·0005 M. used was near the limit for the growth of the host roots.

EHRLICH (J.) & OPIE (R. S.). **Mycelial extent beyond blister rust cankers on Pinus monticola.**—*Phytopathology*, xxx, 7, pp. 611–620, 1 diag., 1940.

Microscopic measurements of the longitudinal extent of the mycelium of *Cronartium ribicola* beyond the outer limits of superficial discoloration in the bark of *Pinus monticola* [*R.A.M.*, xix, p. 314] were made on the distal ends of 116 cankers in green stems and branches and on the proximal ends of 146 in green stems and green and flagged branches collected in October, 1935, from three ecologically comparable areas in Idaho. The extent of mycelial progression beyond the externally discoloured area ranged from 0·5 to over 3 cm. (5·5 cm. in one canker), with a mean of 1·66 cm. The mean extents were found to be approximately 2·3, 1·5 to 1·6, and 1·2 cm. for cankers on green stems and green and flagged branches, respectively. Mycelial extent was found to be variously correlated with the estimated age of the canker, the stage of the canker, the thickness of the bark at the outer limits of surface discoloration, and the diameter of the cankered internode at the same region. Internode diameter was adjudged to be a useful criterion for the field appraisal of mycelial progress.

YOUNG (H. E.). **Fused needle disease and its relation to the nutrition of Pinus.**—*Qd agric. J.*, liii, 1, pp. 45–54; 2, pp. 156–177; 3, pp. 278–315; 4, pp. 374–392; 5, pp. 434–452, 35 figs., 1 diag., 8 graphs, 1940.

This paper contains the results of many years' extensive investigations of the needle fusion disease of pine in Queensland [*R.A.M.*, xviii, p. 502]. This condition is considered to be only one of a number of closely related abnormalities and a limiting factor in the establishment of exotic pines in certain localities. Experiments showed that soil is the only factor directly bearing on the condition, while genetic factors are thought to act in a secondary manner. Minor elements and the physical nature of the soil are dismissed as primary causes, but the action of phosphorus in relation to pine nutrition is considered to be of major importance. The organic matter complex was found to be fundamentally related to the occurrence of the disease. In a number of field experiments, fused needle and related abnormalities were successfully controlled by the use of phosphatic manures, which are believed to increase the litter due to the stimulation of natural vegetation, stimulate the growth of fungi, thereby increasing the production of organic matter,

assist the phosphatide excretion of the roots, which results in better mycorrhizal development, and aid directly the nutrition of the pine tree. The last-named is thought to be unimportant. It is suggested that fused needle and related manifestations of malnutrition are intimately connected with the mycorrhizal complex. The deficiency of raw organic matter following the clearing and burning of the natural forest results in an unhealthy mycorrhizal condition and is directly responsible for the malnutrition of the tree. The phosphate dressings bring about a return to healthy mycorrhizal development; before treatment the fungi tend to become actively parasitic, but afterwards they become non-parasitic and are digested by the root cells. A carbohydrate hypothesis for the physiologic role of tree mycorrhiza is advanced, according to which normal mycorrhiza supply the tree with an essential part of their carbohydrate requirement, and fused needle is believed to be due to the inefficient functioning of the mycorrhiza in this respect. The application of additional phosphorus to soils low in this element leads to a more abundant phosphatide excretion from the pine roots, establishing a satisfactory balance of conditions for correct mycotrophic activity. Soil analyses have shown that the minimum total phosphate content required by *Pinus taeda* is 135 p.p.m. and for *P. caribaea* 110 p.p.m. The condition may be economically remedied by a broadcast dressing of calcium superphosphate.

In dry areas with fertile soils, fused needle appears to be due to moisture deficiency, resulting in inadequate litter formation suitable for mycorrhizal activity.

Smith (C. O.). **Galls on Pseudotsuga macrocarpa induced by Bacterium pseudotsugae.**—*Phytopathology*, xxx, 7, p. 624, 1 fig., 1940.

Inoculation tests with *Bacterium pseudotsugae* from Douglas fir (*Pseudotsuga taxifolia*) on *P. macrocarpa* at the California Citrus Experiment Station produced galls resembling those described by Hansen and R. E. Smith on the original host [*R.A.M.*, xvi, p. 718]. Similar results were obtained on *P. taxifolia* var. *glauca*, but *Abies concolor* reacted negatively to infection.

Milbrath (J. A.). **Coryneum blight of oriental Arborvitae caused by Coryneum berckmanii n. sp.**—*Phytopathology*, xxx, 7, pp. 592–602, 3 figs., 1940.

Latin and English diagnoses are given of *Coryneum berckmanii* n. sp., the agent of a destructive blight of oriental arbor vitae (*Thuja orientalis* var. *conspicua*) in Oregon, the symptoms induced by which include a reddish-brown discoloration and shedding of the small branches, girdling of the ends of the infected areas of larger twigs, and the development of a pale grey cast over the foliage. Infection is spread to the new growth by means of spores, with progressive devitalization and ultimate death of the tree. The young scale leaves of the terminal branchlets constitute the foci of primary infection, which is facilitated by small wounds, though uninjured tissues may be penetrated. The woody stems at the base of infected twigs are not girdled, but small, inactive cankers develop on them. Sporulation is confined to the scale leaves or the small stems enclosed therein.

Besides *T. orientalis* var. *conspicua*, the varieties *beverleyensis*, *elegantissima*, *compacta*, and *stricta* and *Cupressus sempervirens* var. *stricta* are subject to natural infection (the last-named only occasionally). When 50 *T. orientalis* plants were interspersed in an infected stand, 39 became blighted during the first two years.

The causal organism is characterized by black, erumpent, pulvinate acervuli, 246 μ in diameter, and oblong to fusoid, 5-septate conidia, 24·8 to 36·5 by 8·6 to 11·5 (average 28·8 by 9·9) μ, with the four median cells olive-brown and the two terminal hyaline, furnished with pedicels 13·3 to 25·1 (23·3 by 2·3) μ, and borne on profusely branched, septate, hyaline conidiophores, 26·6 to 53·2 by 2 to 2·6 (42·6 by 2·3) μ, without paraphyses. The only other 5-septate species of *Coryneum* known to be pathogenic is *C. cardinale*, a parasite of *Cupressus macrocarpa* in California [*R.A.M.*, xix, p. 623], from which *Coryneum berckmanii* differs in its non-loculate stroma, type of acervulus, smaller spores, and cultural characters. *C. cardinale*, moreover, attacks mature woody stems, while *C. berckmanii* is confined to the foliage and young stems. The latter species grows rapidly at room temperature on potato dextrose agar until a diameter of 20 mm. is reached, after which the rate of development declines and ceases at a diameter of 35 to 40 mm.; at 50° to 65° F. almost twice as much growth is made as at 75° to 80° and continues until the plate is covered. The colonies are pale to salmon-pink in the centre, fading to white at the edge, sometimes zonate. The fungus develops similarly on maize meal, bean pod, and Lima bean agars, but growth on prune agar is very sparse, the mycelium being entirely submerged and the colonies olive-brown. On agar media spores are produced only in cultures several months old exposed to temperatures below 65°, but profuse sporulation, in the form of pustules 1 to 2 mm. in diameter, occurred in a few weeks on wet, autoclaved oat grains.

The artificial inoculation of *T. orientalis* with *C. berckmanii* presents considerable difficulties, the best results being secured by the introduction of fragments of mycelium or spore masses under the imbricated leaves near the branchlet tips, which induced a condition indistinguishable from natural infection, especially in plants exposed to the cold autumn rains shortly after inoculation. In the north-west, primary infections are initiated in October, and by November foci 1 to 2 mm. in diameter develop and produce spores, which are splashed on to the healthy foliage and give rise to secondary infections, this process persisting until February or March. With the onset of warmer and drier conditions, the spread of the fungus ceases, but many of the small girdled branches turn brown and die.

Satisfactory control of the blight may be effected by one application of red copper oxide (3 in 100) or basic copper sulphate (2 in 50) before the establishment of initial infection in the early autumn.

VOGEL (F. H.). **Some notes on the preparation of Cyathus stercoreus as a test organism for the rapid determination of decay resistance in treated timbers.**—*Pap. Mich. Acad. Sci.*, xxv, pp. 179–185, 1940.

The author recommends the use of *Cyathus stercoreus*, the most common bird's nest fungus in the Lake States, as a test organism for the

rapid determination of decay resistance in treated timbers. The fungus is grown in pure culture on malt agar (1 to 2·5 per cent. Trommer's liquid malt, and 1 to 2·5 per cent. bacto-agar) and as soon as the mycelial mat completely covers the agar, sterilized wood test strips are laid flat on the fungus and allowed to remain for the duration of the test. The sterilization technique of Schmitz, von Schrenk, and Kammerer [*R.A.M.*, xviii, p. 4], by which the wood is dipped intermittently in boiling water, was adopted, the moisture in the wood expediting attack and preventing early drying out of the cultures. At the conclusion of the experiment the test blocks are examined and the condition of the wood noted before determination of final oven-dry weight.

By using *C. stercoreus* it was possible in one week to arrange 22 American woods in an order corresponding almost exactly with relative durability ratings published after long research.

BAXTER (D. V.). **Some resupinate Polypores from the region of the Great Lakes. XI.**—*Pap. Mich. Acad. Sci.*, xxv, pp. 145–170, 12 pl., 1940.

This is a critically annotated list of 10 resupinate Polypores from the Great Lakes region of the United States, Alaska, the Yukon, the Northwest Territories, and Canada [cf. *R.A.M.*, xix, p. 309], including one new species.

Dealing with *Poria incrassata*, the author states that this fungus, reported from Ontario, the District of Columbia, and 20 of the United States, does not occur in forests, appearing only in buildings and stacked timber. It attacks every commercial species of wood, and is particularly prevalent in the south and north-west in buildings where there is heavy condensation of moisture in walls and between floors and sub-floors, though it is also frequently found in buildings in which moisture is not excessive [ibid., iii, p. 563]. Lumber shipments appear often to be responsible for the appearance of this fungus in other districts. It frequently spreads in the joists and baseboards and passes up into door and window frames. In some cases it has destroyed the timber in a second story and progressed to the third. The author observed it running up concrete posts and passing through wooden flooring more than 4 ft. from the ground into piles of kiln-dried lumber stacked in dry sheds, and several thousand feet of this lumber had to be re-sawn to save what was still saleable. The evidence indicates that in the south, at least, the association between *P. incrassata* and termites is less close than has been believed.

RICHARDS (C. AUDREY) & CHIDESTER (MAE S.). **The effect of Peniophora gigantea and Schizophyllum commune on strength of Southern Yellow-Pine sapwood.**—*Proc. Amer. Wood Pres. Ass.*, xxxvi, pp. 24–31, 3 figs., 1 diag., 2 graphs, 1940.

Logs of freshly felled loblolly and slash pines (*Pinus taeda* and *P. caribaea*) were quarter-sawn into 1¼ by 1¼ by 15 in. specimens and three-fifths of the number inoculated, after 20 minutes' steaming at atmospheric pressure, with pure malt agar cultures of *Peniophora gigantea* [*R.A.M.*, xviii, p. 361], *Schizophyllum commune* [ibid., xix, p. 175], or *Lenzites sepiaria*, the remainder being left as controls. After

four months in the laboratory, *L. sepiaria* had produced a brown, crumbly rot in localized areas of the wood, and at the end of six months the inoculated pieces were too badly decayed for further testing. *P. gigantea*, though less detrimental to the strength properties of *Pinus taeda* than *L. sepiaria*, did cause a substantial decrease. In four months, fibre stress at proportional limit, modulus of rupture, work to proportional limit, and work to maximum load were reduced by over 50 per cent. in both *P. taeda* and *P. caribaea* by *L. sepiaria*, whereas the maximum average reduction caused by *Peniophora gigantea* was 35 per cent. in work to maximum load in the *Pinus caribaea* specimens infected for six months, the corresponding figure for *P. taeda* being 20 per cent. *S. commune* gave less uniform results than the other two fungi, but for the most part caused little or no decrease in the strength of the test pieces except in work to the proportional limit.

BOLLER (E. R.). **Zinc chloride-petroleum treatment for ties.**—*Proc. Amer. Wood Pres. Ass.*, xxxvi, pp. 361–376, 6 figs., 1940.

A tabulated account is given of experiments in the zinc chloride-petroleum method of railway sleeper preservation, using five kinds of wood, viz., red and white oaks [principally *Quercus borealis* and *Q. alba*], western yellow and lodgepole pines [*Pinus ponderosa* and *P. contorta*], and Douglas fir [*Pseudotsuga taxifolia*], from which it appears that the best results are secured by a successive two-movement process involving (in laboratory tests) initial air pressure (60 lb. for 30 mins.) or vacuum (27 in.), a zinc chloride pressure period of 3½ to 5 hours at a maximum temperature of 180° to 240° F. and maximum pressure of 125 to 200 lb., an oil pressure period of 3 to 6 hours at a maximum temperature of 180° to 250° and maximum pressure of 125 to 200 lb., an intermediate vacuum of 1 to 1½ hours at a maximum of 27 in., an oil pressure period of 2½ to 5 hours at a maximum temperature of 210° to 250° and maximum pressure of 125 to 200 lb., and a final vacuum of 0 to 5 minutes. The retention of zinc chloride and oil ranged from 0·40 to 0·79 and 2·59 to 14 lb. per cu. ft., respectively. The two substances penetrated from 60 to 100 per cent. of the wood in the red oak tests and all the sap wood and ⅛ heartwood in the white oak tests; zinc chloride penetrated 60 to 90 per cent. of the wood in the *Pinus ponderosa* series and oil 25 to 90 per cent., the depth of penetration of the two substances in the Douglas fir tests being 1 to 2 in. and 1/16 to 1¼ in., respectively. All the sap wood and half the heartwood were penetrated both by the chloride and oil in tests on *P. contorta*.

In an experiment on a semi-commercial scale in a cylinder 18 by 4 ft. belonging to the Indiana Wood Preserving Company, using partially or thoroughly seasoned red oak, about three hours' immersion in 5·5 per cent. zinc chloride (empty-cell process) was necessary to secure complete impregnation of the dry wood, and five hours' vacuum for an average retention of 8 lb. oil per cu. ft. In the case of the green wood a period of five hours was requisite both for the chemical and oil treatments.

A few preliminary tests were carried out with a zinc chloride-tar (2 parts gas-house and 1 part coal) mixture on southern yellow pine [*P.* spp.], using a successive two-step procedure similar to that already

described, with very satisfactory results. A fairly high temperature (240°) was necessary to obtain good penetration of the particular blend of highly viscous tar employed in these trials.

DEARBORN (C. H.). **Magnesium deficiency in Cauliflower in Delaware County, New York.**—*Proc. Amer. Soc. hort. Sci.*, xxxvii, pp. 773–777, 1 fig., 1940.

In 1937, a chlorosis of cauliflowers was general in Delaware County, New York, causing severe losses in several areas. The first symptom is a yellow interveinal mottling on the lower leaves, rather uniformly distributed over the whole leaf. Young leaves are rarely affected. In wet seasons, the chlorotic parts fall out, while in dry weather they become dry and tan-coloured. When the affected leaves remain intact they become stiff and bronze-coloured, but retain their shape. The condition generally results in abscission of the lower leaves and conspicuous reduction in the size of the head. The results of field experiments indicated that the condition may be avoided by an application to the soil of magnesium oxide at the rate of not less than 300 lb. per acre. Even where symptoms were not apparent, significant increases in the number and weight of saleable heads resulted from the use of dolomitic hydrated lime. A greenhouse experiment also showed that the addition of magnesium sulphate to the field soil in pots induced a marked increase in the average weight per plant. From the results of these studies it is concluded that the condition is due to magnesium deficiency.

REINKING (O. A.) & GLOYER (W. O.). **Yellows-resistant varieties of Cabbage suitable for New York State.**—*Bull. N.Y. St. agric. Exp. Sta.* 689, 28 pp., 3 figs., 1 map, 1940.

Particular importance attaches to the development of cabbage varieties resistant to yellows (*Fusarium conglutinans*) in New York, the leading State of the Union in the production of this crop, which cannot at present be grown at all in many of the areas suffering severely from the disease. As a result of replicated experimental plantings in 1937, 1938, and 1939, it was found that any of the following mid-season or 'kraut' varieties may be recommended for cultivation in infested fields: Racine Market, Early Copenhagen Resistant, Marion Market, Glory Yellows Resistant, Globe, All Head Select, and Wisconsin All Season [*R.A.M.*, xvii, p. 218], all with resistance ratings of 95 to 100 per cent. except the last-named (90 to 100). Among early varieties, Jersey Queen is highly resistant (98 to 100 per cent.) but unprolific, while Detroit Resistant and Resistant Golden Acre (80) need further selection. None of the late (Danish) varieties entirely meets the requirements of the New York market, but Wisconsin Ballhead (97 to 100 per cent. resistance) should prove useful for immediate consumption, while the highly resistant Wisconsin Hollander types are more suitable for storage.

YOUNG (H. C.). **Dusting or spraying for the control of the blight of Sugar Beets.**—*Sug. Beet J.*, v, 5, pp. 87, 89, 92, 1940. [Abs. in *Facts ab. Sug.*, xxxv, 8, p. 36, 1940.]

Sugar beet blight (*Cercospora*) [*beticola*] is stated to be now causing

heavy annual losses in Ohio instead of, as formerly, in only one season out of five or seven [*R.A.M.*, xix, p. 1]. The results of spraying and dusting experiments in 1938 and 1939 clearly demonstrated the profitability of control measures, which increased the tonnage by 20 to 50 per cent. In both years the disease was serious, the untreated plots showing about 90 per cent. dead leaf area on 1st September. In general, dusting gave slightly higher yields than spraying, while the latter was somewhat more effective in the elimination of the pathogen. Copper-lime dust (20 : 80) was the best of the compounds tested, coverage and adhesiveness being improved by the admixture of 15 lb. flour and a reduction of the lime content to 65 lb. Applications should be made at ten-day intervals, early planted beets being given four treatments. The critical period for infection appears to be reached about six weeks after blocking and thinning. The total cost of dusting (three applications), using either the above-mentioned formula or fixed copper-lime (12 lb. tribasic, 73 lb. talc, and 15 lb. flour), is under $5, reckoning 33⅓ lb. dust per acre per treatment. In most of the eastern beet-growing areas the yield and sugar reductions due to blight are from 2 to 5 tons per acre and 1 to 1½ per cent., respectively, and the average net increase from dusting amounts to $25 per acre.

Service and regulatory announcements January–March, 1940. Announcements relating to Coffee quarantine (No. 73). Announcements relating to fruit and vegetable quarantine (No. 56). Present status of this (B.E.P.Q.) series. Plant quarantine import restrictions, United Kingdom of Great Britain and Union of South Africa. —*S.R.A., B.E.P.Q., U.S. Dep. Agric.*, 142, pp. 3–4, 4–7, 15–23, 23–36, 1940.

As from 1st April, 1940, no unroasted seeds or beans of coffee, coffee berries or fruits, or coffee plants and leaves may be imported into Puerto Rico (unless by the Department of Agriculture for scientific and experimental purposes or under special exemption permits) as a precautionary measure against the introduction of rust (*Hemileia vastatrix*).

By Amendment No. 1 to Quarantine No. 56, effective as from 27th February, 1940, Newfoundland is placed on the same basis as Canada with respect to the importation of fruits and vegetables into the United States, except as regards potatoes, which will continue to be excluded on account of wart disease [*Synchytrium endobioticum*].

A list is given of the circulars relating to Federal plant quarantines issued since 18th January, 1915, accompanied by explanatory remarks concerning their validity or otherwise at the present time.

A summary is given of the plant quarantine restrictions in force in the United Kingdom as revised to 6th February, 1940. By proclamation No. 555, effective from 1st February, 1940, the Governor-General of the Union of South Africa has amended Proclamation No. 286 of 1936 [*R.A.M.*, xvi, p. 640] by the introduction of a clause requiring the accompaniment of consignments of imported potatoes by a certificate of freedom from virus diseases issued by the Department of Agriculture of the country of origin.